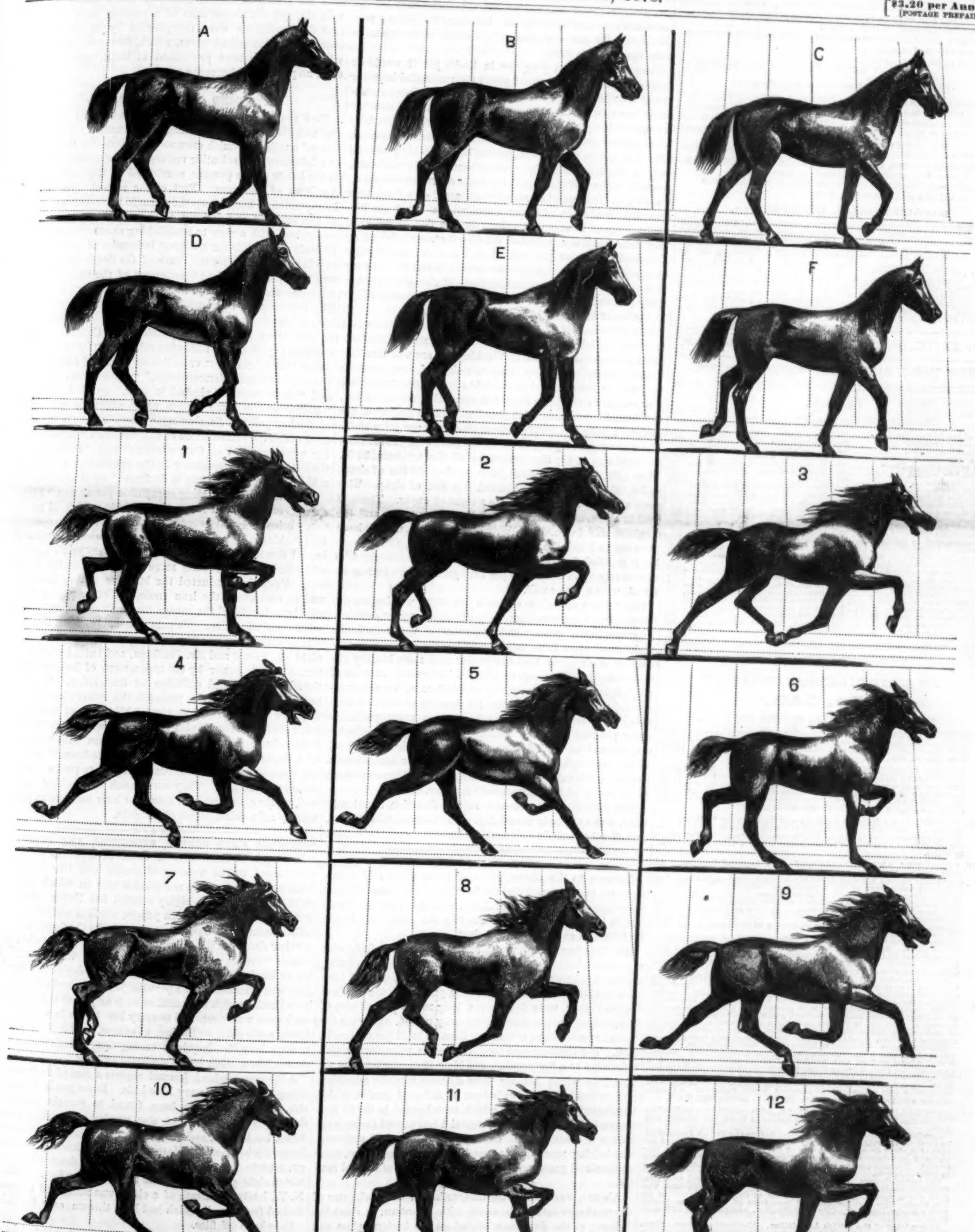
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIX.—No. 16. [NEW SERIES.]

NEW YORK, OCTOBER 19, 1878.

[$3.20 per Annum. [POSTAGE PREPAID.]



THE SCIENCE OF THE HORSE'S MOTIONS.—[See page 241].

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

VOL. XXXIX., No. 16. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, OCTOBER 19, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 146,

For the Week ending October 19, 1878.

IMPROVEMENTS IN SUGAR MAKING WANTED.

A short time since the attention of inventors was called by us to a prize of 100,000 francs ($20,000) offered by the authorities of Guadeloupe for a process that would obtain fourteen per cent of sugar from canes. Through the kindness of U. S. Consul Charles Bartlett, Point à Pitre, Guadeloupe, we are able to add a few important particulars.

In reply to a communication from Mr. Bartlett relative to an improved American cane mill, which would increase the yield of juice from 20 to 30 per cent above the mills in use on the island, the administration replied that improvements of that sort were not what the Council had in view when the premium was offered. What is called for is a process of treating the juice which shall bring the yield of sugar up to 14 per cent. All the expenses of transit, fitting up of the apparatus on the island, and others connected with the experiments are to be borne by the inventor, the colony providing only for the expenses of a special commission to make the requisite tests.

The prize is worth trying for in itself: yet it would be small compared with the total profit the successful inventor would reap from his patents in Cuba and elsewhere, particularly our own land. The sugar industry of this country is comparatively undeveloped; and there is no reason why we should not supply ourselves with this necessary commodity. The notion that cane sugar can be profitably produced only in hot and unhealthy regions seems to be a mistake. According to an official report from our consul at Hamilton, Canada, an Ohio man has raised this season, on a farm near that city, five acres of sugar cane, which has been pronounced equal to any ever grown in the Southern States. The cane attained a height of thirteen feet, and yielded an abundant saccharine product. It is believed that the cultivation of sugar cane will soon become an extensive industry in that region; and if successful there, it should succeed in many parts of the States, away from the miasmatic valley of the lower Mississippi.

The experiments in sugar making from cornstalks and sorghum, which Dr. Collier of the Department of Agriculture has been carrying on in Washington, are worth noting in this connection. The aggregate weight of the cornstalks used was 11,237 lbs., and the weight of sorghum 13,958 lbs. The weight of the juice from the cornstalks was 2,773 lbs., and from the sorghum 4,963 lbs. The specific gravity of the cornstalk juice was 10·54; that of the sorghum juice 10·58. The percentage of juice in the cornstalks as they came from the field was 24·68; the percentage of the sorghum, 35·56. Thus 2,571 lbs. of cornstalk juice yielded 382 lbs. of sirup, and 4,355 lbs. of sorghum yielded 660 lbs. of sirup. This sirup contains 75 per cent of its weight of sugar. The mill used in these experiments was an indifferent one, and the sorghum was in small stalks. Better results would have been reached had the stalks been larger. Dr. Collier says he is satisfied that there is not a farmer in the country who cannot rely upon results 50 per cent greater than he has secured, with a better mill.

Since the cultivation of beets for sugar was begun, the percentage of sugar in the root has been more than doubled. Like care in the getting and perfecting of the more hardy varieties of sugar cane might very largely increase the saccharine product, so that our cooler and more healthy climates might easily compete with the best sugar countries of the tropics. And it is quite possible that with a vastly increased product of sweet corn for summer use and for canning, there might be developed an even more profitable sugar product from the stalks. In this way two valuable crops could be reaped from the same ground, at one time, with a very slight increase of labor. The corn leaves would have no small value also for fodder, and possibly the pressed stalks would yield a fair revenue for fiber.

The field for improvement in this direction is not only wide, but extremely promising. Our farmers, mill-makers, and chemists will do well to work it.

DUST EXPLOSIONS.

Apropos to the discussion concerning flour mill explosions we are informed that the burning of the large fertilizer manufactory in the town of Lake, near the Chicago Stock Yards, in January, 1874, was due to a like cause, that is, the ignition and explosion of fine dust.

The building was of wood, one story, 75 x 100 feet, with a wooden addition about 20 feet square. In the main building the fertilizer was manufactured from the blood and tank stuff received from the neighboring packing houses; mixed together they were fed into a long revolving cylinder of iron, through which flame constantly passed, and were delivered as a fertilizer containing from 15 to 18 per cent moisture. The fertilizer was then fed into a pulverizer, which reduced it to a fine powder, and blew it through a long tin pipe (into which hot air from a heater was also admitted) into cylindrical sieves or bolters of different grades, which terminated the pipe and which were located in the 20 foot square building. After the material had passed through the bolters it contained but from 6 to 8 per cent of moisture. The bolting room always contained hot air, hot steam, some ammoniacal gases, and the fine floating dust of animal matter.

About a week before the destruction of the works one of the workmen entered the room, with a lantern, to clean the bolters; as the dust soon settled on the lantern glass and obscured the light he opened it to take the lamp out that he might see better; an instantaneous explosion followed, and he was thrown down, and his hair, face, hands, and clothes badly scorched. The force of the explosion was, however, expended through the open door, and no further damage resulted.

A week after this occurrence, on another occasion of the clogging of the bolters, the intelligent foreman of the factory entered the room with the lantern, with two of the workmen, and repeated the interesting performance of exposing the naked light, with disastrous results; the explosion shook from the beams and rafters of the buildings the long accumulation of dry fertilizer dust, which was at once ignited by the burning gas, and the whole building was instantly filled with flame and burned to the ground.

From this it is evident that the dry dust of animal as well as that of vegetable matter will take fire and generate gas with explosive rapidity, provided the necessary conditions are presented, that is, sufficient and intimate mixture with air, and the temperature of a burning lamp. In this case the conditions were complicated by the presence of steam and ammoniacal gases, which, however, contrary to what would have been predicated of them, apparently excited no preventive influence.

A SECOND MATTHEW VASSAR.

Two years ago, Mr. J. C. Jacobsen, a wealthy brewer in the neighborhood of Copenhagen, Denmark, set aside the sum of a million Danish crowns—$275,000—for the support of a laboratory for scientific research. The money is vested in the hands of five persons, nominated by the Danish Royal Academy of Sciences. Part of the annual revenue is to be expended in keeping up the splendid laboratories attached to the brewery and devoted to chemical and physiological researches, with a view to establishing as complete a scientific basis as possible for the great industries of brewing and malting; the rest, after the death of the donor and his wife, will be expended in the advancement of the various natural sciences—mathematics, philosophy, history, and philology. The laboratory is fitted up in the most liberal manner, and already excellent work has been done in it. The first report of such work has just been published in Copenhagen, and contains papers on the following subjects: "On the rotatory power which beer wort exercises on polarized light, and on its variations during fermentation," "Estimation of extract," and "Estimation of alcohol in beer," by M. J. Kjeldahl; "Researches on some factors which affect the propagation of the low yeast of *Saccharomyes cerevisiæ*;" "On the influence which the introduction of atmospheric air into fermenting wort exercises on fermentation;" and "Researches on the influence of temperature in the production of carbonic acid on barley germinating in darkness," by M. R. Pedersen.

From the nature of their occupation our successful brewers are compelled to become interested in science, if not actually scientific. At every stage in the varied processes of beer making a high order of chemical knowledge is valuable, indeed almost indispensable; and with every year's advance, scientific brewing becomes more and more essential to success. Properly conducted the business is very profitable; and so commerce, the iron trade, and other paying industries have furnished the means for many munificent gifts to science and education. We may reasonably expect that there will be among our wealthy brewers not a few who will emulate Mr. Vassar and Mr. Jacobsen, and build lasting monuments to their honor by the endowment of institutions for the advancement and diffusion of knowledge. There are several fields of scientific research the cultivation of which might be greatly helped by the establishment of working laboratories after the Danish model; and we have several millionaire brewers who might provide them handsomely out of a single year's profits. As a class the brewers are notably freehearted and generous in regard to public improvements and the like. They owe much to practical science, and, we are confident, will sooner or later make many praiseworthy acknowledgments of the debt.

POISONOUS HATS, GLOVES, STOCKINGS, AND CLOTHING.

It is not long since several cases of arsenical poisoning were traced to the wearing of scarlet and blue stockings. Next came a somewhat remarkable case in which the mischief was traced to a highly colored hat lining. More recently English and German papers, medical and other, have called attention to dangerous gloves. In the London *Times* a writer describes the poisonous effect of a pair of the fashionable "bronze green" silk gloves, when worn by a member of his family. After wearing them a day or two the patient was attacked with a peculiar blistering and swelling of both hands, which increased to such an extent that for three weeks she was compelled to carry her hands in a sling, suffering acute pain, and being, of course, unable either to feed or dress herself. Inquiries among the writer's friends discovered three other ladies similarly afflicted.

A German medical journal reports a case of serious poisoning by a pair of navy blue kids. Dress goods of woolen, silk, and cotton have been found to contain arsenic in dangerous quantities; so also gentlemen's underclothing, socks, hat linings, and the linings of boots and shoes. Professor Nichols, of the Massachusetts Institute of Technology, reports the examination of a lady's dress which contained eight grains of arsenic to the square foot. In Troy, N. Y., lately, the death of a child was attributed to arsenic sucked from a vail which had been thrown over the child's crib to keep off flies.

At this rate it will soon become necessary to test for arsenic all goods purchased before venturing to wear them; or else the label—"warranted to contain no poisonous dye"—

will have to be adopted by all honest and reliable makers. Hitherto, we believe, the retail dealer has not been held legally responsible for damage done in this way. We do not know that he can be—except on the charge of dispensing poisons without a license. Evidently, however, something should be done to put a stop to the rapidly increasing evil. If the obnoxious tints cannot be secured safely as well as cheaply, then they ought to be prohibited, and another process of dyeing made imperative. Our young chemists will find a fruitful field for the exercise of their inventive powers in the production of the needed dyes.

THE PAUPER TRIBE.

The difference between poverty and pauperism, though wide as the world, is too often overlooked. The best of men may become poor; may honorably reach the point of actual destitution; indeed, it has not unfrequently happened that the world's best benefactors have experienced extreme poverty, sometimes by resolutely pursuing the course which has ultimately brought them to the highest financial and industrial as well as moral success. No combination of circumstances, however, no matter how disastrous, could make such men paupers. The pauper is made of very different material: he is what he is too often by preference, very often by inheritance.

Last year Dr. Hoyt, Secretary of the New York State Board of Charities, visited sixty-four poorhouses, containing 13,000 public paupers. Less than one fourth were of American parentage. In fifty-five cases investigated the pauperism extended to the second generation on the father's side, and in ninety-two cases to the third generation on the mother's side. Three hundred and ninety-seven had pauper fathers; one thousand three hundred and sixty-one had pauper mothers; and so on. Their pauperism was hereditary. The close relation of criminality with inherited pauperism —the more forceful members of such families preferring to seize what they want rather than beg for it—is shown in the history of the well known "Jukes" family, which, in one hundred and fifty years, furnished this State with eight hundred and thirty criminals of baser types, besides many imbeciles, lunatics, and other undesirable characters.

Professor Brewer, who has given much study to the pauper and tramp problem, is confident that wherever the genesis of paupers is thus looked into there will be found abundant evidence of a pauper tribe well established among us, and perpetuating its instincts in its descendants. For this class no mawkish sentimentality will answer; they need strict justice. The class as a class must be rooted out by resolute treatment. The chain of criminal entailment must somehow be broken in them or they will breed a moral pestilence. Against such outlaws, "for whom," as a contemporary has said, "childhood has no sanctity, hospitality no safeguard, and property no rights," only vigorous measures will suffice. There is enough of honest poverty, through flood and fire and sickness, to furnish occupation to the charitable without the burden of voluntary pauperism, the effect of which is too often to steel the hearts of the sympathetic against all poverty and distress. The honest seeker for employment is confounded with the professional tramps, of whom the most charitable of communities are becoming heartily sick. In justice to the deserving poor—and there is always a large class which, through no fault of their own, may become poor—the pauper tribe should at least receive no encouragement.

For many years in this country the single fact that a person was in need of food or clothing or shelter was held to be a valid reason for giving what was asked. The country became in consequence a perfect paradise for the pauper tribe. They fared so well that multitudes brought by adverse circumstances to poverty were tempted over the line into pauperism; and many others lingered on the verge, passing their time between unwilling labor, pauperism, and petty criminality. Out of these has grown a class of criminal vagrants, now by far the worst disturbers of the public peace and the public moral health.

Indeed, the Indian problem, bad as it is, is a trifle compared with that arising from the existence of the pauper tribe. The Indian is on the frontier; the vicious tramp is everywhere. And it is safe to say that, year by year, the life and property destroyed by the tramp tribe exceeds that due to Indian depredations. If we are justified in spending millions in Indian wars, in placing upon reservations and trying to civilize the one class of savages, much more justifiable must be the taking of measures, national in scope and magnitude, to control and reclaim if possible the other. Nothing short of this, we fear, will ever rid us of the pest.

PUBLIC SANITATION.

Formerly, Galveston, Texas, was accustomed to have an epidemic of yellow fever every three or four years. The last and worst the city ever suffered from was in 1867. At that time the level of the city was low, and there was standing water under nearly all the older houses. Seeing that the fever spread most rapidly and was most fatal where the stagnant water stood, it was ordered that the grade of the city should be raised four feet, and that the space beneath every house that had water under it should be filled with sand. At the same time the system of surface drainage was improved, and strict sanitary regulations were adopted and enforced. The result has been that Galveston is one of the cleanest cities in the United States; and, though made a place of refuge for yellow fever victims, the disease has failed to spread there. The value of such sanitary care was particularly tested in 1873, when the disease was very fatal in Memphis, Shreveport, and in Texas. The healthfulness of the city this summer is attributed more to its perfect sanitary condition than to the quarantine that has been maintained against infected ports. It is now eleven years since the fever was epidemic in Galveston, and the citizens believe that with proper attention to sanitary precautions they need never suffer again as they did in 1867. In view of these facts a contemporary remarks that it "will probably be found, when the history of the present epidemic in the South is written, that in every city which has suffered the soil had been prepared for the introduction and spread of the disease by the neglect to observe sanitary rules. The yellow fever would certainly lose many of its terrors if every Southern city was kept as clean as Galveston."

Setting aside the terrible cost of the present epidemic in suffering and death, because it is incalculable, the computable cost in direct contributions, and indirectly through the cessation of Southern industry and the derangement of Northern trade, would probably suffice to keep every one of the fever smitten cities in proper sanitary condition for a whole generation. Indeed it would pay the business interests of New York alone to assume the expense of keeping the fever districts clean. So large is our share of the penalty an epidemic imposes, so intimate, in fact, are the social and commercial relations of the most widely separated parts of our great country, that one part cannot suffer without hurting all. Accordingly it may be a reasonable question whether public sanitation might not be made a national matter, that the influence of unsanitary local customs, conditions and prejudices might be more successfully combated and eradicated. The loss entailed by preventable sickness and death throughout the country—preventable by means already at our command—doubtless amounts to more every year than the cost of our State and National governments; and it would pay the people as a whole to insist on higher sanitary standards and more efficient public sanitation for every community.

As evidence of increasing interest in this direction, we may mention the Yellow Fever Commission, made possible by the generosity of a lady in this city. The commission will be composed of eminent physicians, North and South, including the President of the American Public Health Association. The great object of the inquiry will be to discover measures for the prevention of future epidemics; and it is to be hoped that the subscriptions for the furtherance of the work will be so generous that too limited means may not lessen the scope and thoroughness of the commission's labors.

A HORSE'S MOTION SCIENTIFICALLY DETERMINED.

A short time since the SCIENTIFIC AMERICAN briefly noted the fact that Mr. Muybridge, of San Francisco, had perfected an automatic electro-photographic apparatus, by means of which he had succeeded in recording the action of horses in motion. Mr. Muybridge courteously responded by forwarding a series of instantaneous photographs, showing with absolute accuracy the motions of horses when walking, trotting, and running. From these we have selected two series, the first showing the movement of the horse "Abe Edgington," while walking at a 15 minute gait; the second showing the same horse while trotting at a 2:24 gait. These —omitting the driver and his sulky—we have had enlarged and skillfully engraved, as shown in the illustration on the first page.

In taking the negatives of these photographs, Mr. Muybridge employed a series of cameras, operated by electricity, and so placed as to fix with absolute accuracy the several phases in the continuous action of the horse while making one stride. The exposure for each negative was about the two thousandth part of a second. The vertical lines on the background are twenty-eight inches apart; the heavy horizontal line represents the level of the track; the others mark elevations of four, eight, and twelve inches respectively. These lines are necessary for the analysis of the movement of the horse.

It will be seen that the walking horse always has two feet on the ground, and, for a brief interval in each stride, three feet. The positions of the feet shown in Figs. A and E indicate a stride of 4 feet 4 inches. When trotting at a 2:24 gait, the stride of the same horse is over 18 feet.

Figs. 1 to 12 show the latter motion. In Figs. 4 and 5, and again in 9 and 10, the horse is entirely off the ground, literally flying through the air. In his analysis of the stride, Mr. Muybridge notes that with this stride, moving at a 2:24 speed, the horse is entirely in the air about half the length of the stride, and for a brief interval he has one foot alone upon the ground. The relative time that a horse is on or off the ground is probably dependent upon his length of limb and stride, and rate of speed.

The limit of our space forbids any attempt to follow the movements and positions of the four feet throughout the stride, further than to note that the figures from 1 to 6 depict half a stride, the remaining figures the other half.

The most careless observer of these figures will not fail to notice that the conventional figure of a trotting horse in motion does not appear in any of them, nor anything like it. Before these pictures were taken no artist would have dared to draw a horse as a horse really is when in motion, even if it had been possible for the unaided eye to detect his real attitude. At first sight an artist will say of many of the positions that there is absolutely no "motion" at all in them; yet after a little study the conventional idea gives way to truth, and every posture becomes instinct with a greater motive than the conventional figure of a trotting horse could possibly show. Mr. Muybridge's ingenious and successful efforts to catch and fix the fleeting attitudes of moving animals thus not only make a notable addition to our stock of positive knowledge, but must also effect a radical change in the art of depicting horses in motion. And every one interested in the physiology of animal action, not less than artists and horse-fanciers, will find the photographs of Mr. Muybridge indispensable.

Our drawings, though admirable and instructive as such, are necessarily inferior to the photographs in scope and variety of detail; and they lack also that element of indisputable accuracy which belongs to the sun pictures. However truthful, an artist's work cannot have the convincing force of a photograph. Six series of cards have been published, with from eight to twelve positions each, illustrating the single strides of trotting, cantering, running, and walking horses. They may be had of Muybridge, photographer, 417 Montgomery St., San Francisco, Cal.

We would suggest that for popular use the photographs should also be mounted on strips for use in the zoetrope. By such means it would be possible to see not only the successive positions of a trotting or running horse, but also the actual motions of the body and legs in passing through the different phases of the stride.

IMPROVED EDUCATION.

The reign of cram in primary schooling is seriously threatened, and Boston leads the revolt. Henceforth, if success attends the effort, the Boston public school teacher will teach, not simply hear recitations as heretofore; and the pupils will acquire knowledge after the normal method of childhood, by being taught, by seeing and thinking, instead of by the memorizing of words from books. Language will be taught by talking-lessons with and about pictures, plants, animals, everyday life and experience. Oral instruction will also be given upon form, color, measures, animals grouped by habits, vegetables, minerals, hygiene and the human body. The metric system will be taught from the metric apparatus. No spelling books will be used, the reading books taking their place. In the grammar grade, grammar, as generally studied, has been abolished with the spelling book. In the stead of parsing and other technical work, lessons will be given in composition, in the use of capitals, in letter writing and in the arrangement of sentences. Much of the time formerly devoted to geography will be given to natural philosophy and physiology. Oral instruction will be an important feature of all the classes, and in the lowest two it will predominate. In the lower classes the subject for oral instruction will be natural history, plants from May to November, animals from November to May, trades, occupations, common phenomena, stories, anecdotes, mythology, metals and minerals. In the upper classes, physiology, life in the middle ages, biographical and historical sketches, and experiments in physics.

This method labors under one serious, we fear fatal, difficulty—the teachers will have to know something. Their knowledge will have to be real "live" knowledge, not dead verbiage; and they will need to know a good deal about the natural, social and industrial life that the children come in contact with out of doors and at home. Such knowledge is not to be gained from books; and it is hard to turn a book student into a practical observer. We sincerely hope, however, that the teachers of Boston will succeed in their difficult task, and demonstrate to the rest of the world the feasibility of this promising and long needed reform.

The American Institute Fair.

The annual exhibition of the American Institute is now in complete working order, and offers more than its usual array of popular attractions. Though no startling novelties are presented, the general character of the display is somewhat above the average.

Naturally the late advances in methods of generating and applying electric energy make their electrical department specially prominent, the electric light, the new Wallace and Weston motors, Edison's electric pen and carbon telephone being among the chief attractions. There is also an exhibition of the Phelps telephone.

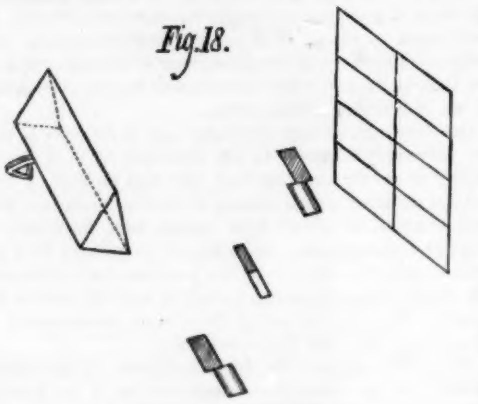
Some attractive and interesting steam and caloric engines are shown in the machinery building, with the usual display of pumps, rock crushers, grinding apparatus, and the like. Light wood-working machinery is well represented, the display of iron-working machines being rather meager. The exhibition of agricultural machinery and implements is good, though not abundant. The same may be said of the fruit and vegetables. The silk looms in operation attract a fair share of popular interest. Among sewing machines the chief novelty appears to be the Wardwell two-spool lock stitch Seamstress. The "noiseless rails" exhibited by Louis Leypoldt should attract a very large share of attention; if they can silence even a part of the clang of elevated roads they will prove themselves a public benefaction of no mean order.

On the whole we do not know a more instructive and enjoyable resort for our citizens han this exhibition, and now that the elevated road makes it more easily accessible than ever before, it should excel its previous years' successes in popularity and influence.

THE SPECTROSCOPE IN SOLAR WORK.

We have hitherto been looking at the sun as spectators, and may have begun to get some idea of the changes visible there to the telescope on a vast diversified surface, which, to the naked eye, is an unaltering white disk.

Fig.18.



NEWTON'S DIAGRAM.

Now, to find out what this great globe is made of we must know how to use the spectroscope, though it is impossible to give complete information about this instrument in a single article. No such attempt will be made here, and this chapter is addressed only to those who are ready to admit to themselves a great deal of ignorance even about its fundamental principles. It would be assuming a good deal to say positively that even these can be clearly explained to all in such space, but the trial may be made, and after this some of the more complex forms of the instrument presented.

To the reader, then, whose mind is in that healthy state where existing ignorance is frankly self-acknowledged, we will recommend to read with us a little from Sir Isaac Newton's "Opticks," the work in which the foundations of our present knowledge are laid, and which takes the student over the very path of discovery. Many illustrations from this survive unaltered in our modern text books, and in some respects, even as a text book, it might replace many of its successors with advantage. As the first steps by which a Newton enters a new field of knowledge must always remain interesting, we give the first experiment of the "Opticks" as nearly as may be in his own words, and reproduce the rude illustration of the early text (edition of 1718):

"PROP. I.

"*Lights which differ in Color, differ also in degrees of Refrangibility.*

"THE PROOF BY EXPERIMENTS.

"Exper. 1. I took a black oblong stiff Paper, terminated by Parallel sides, and with a Perpendicular right Line drawn cross from one Side to the other, distinguished it into two equal Parts. One of these parts I painted with a red colour, and the other with a blue. This paper I view'd through a Prism of solid Glass whose two Sides through which the Light passed to the Eye contained an Angle of about sixty degrees: which Angle I call the refracting Angle of the Prism. And whilst I viewed it, I held it and the Prism before a window in such manner that the sides of the paper were parallel to the Prism, and both those Sides and the Prism were parallel to the Horizon, and the cross line was also parallel to it. Beyond the Prism was the Wall of the Chamber under the Window.

"These things being thus ordered, I found that if the refracting Angle of the Prism be turned upwards, so that the Paper may seem to be lifted upwards by the Refraction, its blue half will be lifted higher by the refraction than its red half. But if the refracting angle of the Prism be turned downward, its blue half will be carried something lower thereby than its red half. Wherefore in both cases the Light which comes from the blue half of the Paper through the Prism to the Eye, does in like circumstances suffer a greater Refraction than the Light which comes from the red half, and by consequence is more refrangible."

Up to Newton's time it was supposed that white light was the purest thing in nature; that, if colored, it was because it was contaminated, and that light of any color was bent out of its course (that is, refracted) in the same degree by a prism. The extremely simple experiment we have just cited is, then, of fundamental importance. Simple as it is, perhaps none has ever been made in optical science of more consequence, for in Newton's hands his "Proposition I.," which we have just given, led immediately to his "Proposition II.," which we will also cite in part; a proposition from the enunciation of which the whole of our present knowledge of the subject may be said to date, and with which begins the progress to which we owe the Spectroscope of to-day.

"PROP. II.

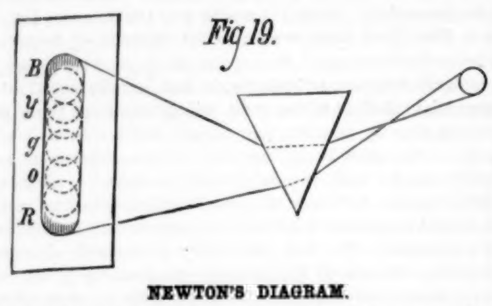
"*The Light of the Sun consists of Rays differently Refrangible.*

"THE PROOF BY EXPERIMENTS.

"In a very dark chamber, at a round hole about one third part of an inch broad, made in the Shut of a Window, I placed a Glass Prism, whereby the beam of the Sun's Light which came in at that hole might be refracted upwards toward the opposite Wall of the Chamber, and there form a color Image of the Sun."

This colored image, Fig. 19, he goes on to show, would have been a circle had the sunlight been of uniform refrangibility. But in fact the refracted image is not a circle, but an oblong figure, five times as long as broad, colored red below and blue or violet above, and with semicircular ends. To give his interpretation in our own words, he finds that the white sunlight really contains all colors. If it were blue light only a perfectly round blue image of the sun would be formed at B. The prism would, in this case, simply throw the image of the blue sun on another part of the wall from where it would otherwise fall (as in the first experiment), but it would in no way distort that image. If the sun were red, a perfectly round red image of it would be formed at R, lower down. But the white light really contains all colors between these two, and therefore not only blue and red, but also green, yellow, and orange circles will

Fig 19.

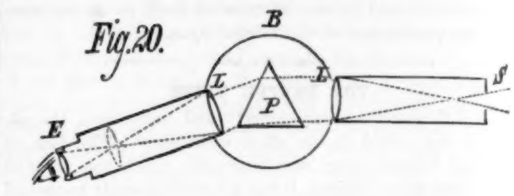


NEWTON'S DIAGRAM.

be formed, as at *g*, *y*, and *o*; and not only this, but every shade between blue and green, between green and yellow, etc., will be represented by a separate circle. The overlapping of innumerable circles then obliterates the circular form, except at the extreme opposite ends, where the furthest visible colors (violet and dark red), having nothing visible beyond to overly them, show the semicircles which terminate the figure. The breadth of the image is greater than that of the hole in the shutter, because the light diverges as it passes through the opening. If we want the width of the colored band (spectrum) to be the same as that of the hole, we need only place a lens behind the prism at a proper distance to make such a picture of the hole on the screen if the prism were not there, and whatever the shape of the aperture, the ends of the spectrum will now reproduce it. Usually the aperture is made, not a circular hole, but a long slit, and hence the ordinary spectrum, drawn as a rectangle, being made of numberless overlapping images of the rectangular slit, and being of course, in this case, terminated with square, not circular ends. Now let us see how we can improve on Newton's primitive apparatus, for, standing on that great man's shoulders, we can doubtless reach higher than he.

We do not need to darken a whole room, or to spoil our "window shut" by boring holes in it, and if we take away the screen and put the eye there, we shall get all the more light. We shall do better yet if we put a telescope between the eye and the prism, to make sharp enlarged pictures of the slit on the retina; and if one prism is good, two or even four will doubtless be better. [A perfectly single-colored image of the slit would not be drawn out by two prisms (or by twenty) any longer than by one, but in practice the blue or green formed by passing through a single prism not being perfectly homogeneous, that is, single colored, the spectrum formed by one prism can always be drawn out further

Fig.20.

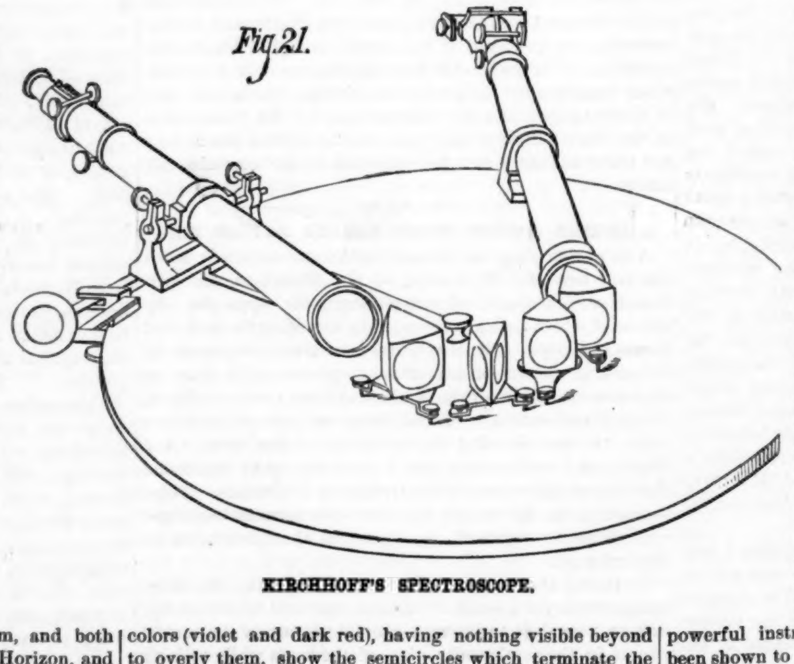


ESSENTIAL PARTS OF SPECTROSCOPE.

by going through another.] Let us, as a last improvement, put a lens (called a collimator) between the slit and the prism, to make the rays parallel before they reach the latter, and we have the modern spectroscope, with which the reader is familiar, at least by engravings, as in Fig. 20. S is the slit which has replaced the hole in the shutter of Newton's day, P is the prism in the little circular box, B, which replaces the darkened room, E is the position of the eye lens, L, L', of the telescope and collimating lenses.

Now turn to a little larger instrument, where the same principles are embodied, as in Fig. 21. It is that with which Kirchhoff and Bunsen made their great map of the spectrum, published in 1861, together with the discoveries to which we shall shortly recur. It will be noticed that the light comes through a slit (at S) from a direction which must be nearly behind the back of the observer, who sits looking in at E. In fact the four prisms bend the light round till the rays almost make a letter U. There is a screw by which the width of the slit can be altered, and the position of the observing telescope and of the prisms can be adjusted so that the ray enters and leaves each of these at the same angle, an important point, which Newton called attention to. But the instrument just shown has been far surpassed by others made since, in which the light has been bent more and more, and the spectrum pulled out longer and longer. After bending it into a U, it was bent so that the rays traveled through more than a semicircle, and the prisms were ranged on a horseshoe shaped curve. Beyond this it might seem that they could not go, without returning on themselves, but there have been many ingenious ways for carrying the dispersion further. Thus, in the annexed illustration, Fig. 22, we may suppose there are two rows of prisms, one over the other, like first and second story rooms along a curved gallery. The light enters through the slit in the lower tube, which contains the collimator, passes round the circle nearly to the point where it came in, is there reflected up and then back, returning on the second story, whence it passes into the observing telescope. In such a way the light may be sent forward and back an unlimited number of times, but in practice the loss of light and other difficulties prevent our going very far in this direction, and in some of the most powerful instruments recently made the disposition has been shown to decrease the number of prisms, and increase their size together with that of the collimator and observing telescope.

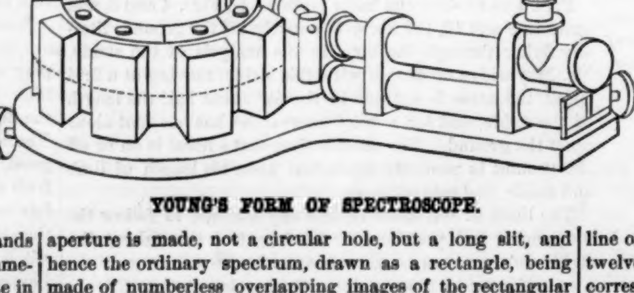
Fig.21.



KIRCHHOFF'S SPECTROSCOPE.

There is also a form of so called "direct vision" spectroscope, where the light is caused to go nearly in a straight line from the slit to the eye, but this convenient method is not well adapted to powerful instruments. The variety even of astronomical spectroscopes, however, is endless, and we cannot pretend to indicate more than a few leading forms. Let us now recur to the spectrum again to see how the instrument is used. It must constantly be remembered that the spectrum is a reproduction of numberless images of the slit, if the latter is transmitting light of all colors; or that if the light have only a part of the colors which might possibly exist in it, images of the slit will be lacking where they would have been formed had those colors been present. Thus if I (Fig. 23) is the slit, and we suppose a whitish light to be made out of twelve absolutely pure colors, none of which shaded into the other, as colors usually really do, each is sent to its own place by the prism, and as it there traces an outline of the slit through which the light enters, we shall have twelve distinct images, at 1, the dark spaces between them corresponding to the intervals between the colors. If there be no such intervals, but the light entering the slit be pure white or a compound of every possible tint, there will be no place on the screen without its image; the images will obliterate each other, and we shall have a "continuous spectrum," as at 2, such as it appeared to Newton and to every one else down to the early years of this century. In 1814 Fraunhofer, a German who had greatly improved the manufacture of optical instruments, using an instrument composed

Fig22.

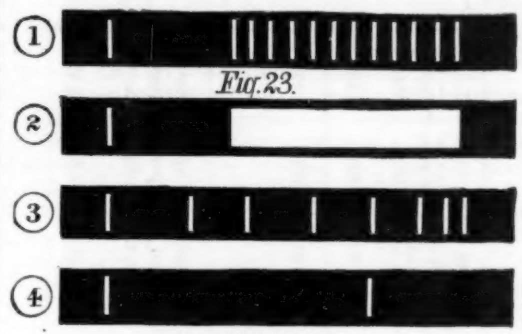


YOUNG'S FORM OF SPECTROSCOPE.

like that in Fig. 20 (but without a collimator), saw for the first time, owing to the greater purity and more accurate figure of his prisms and lenses, a spectrum like that shown at 3, Fig. 23, in which certain images of the slit appeared to be lacking. Their absence made it look as though dark lines had been drawn across the spectrum, and these used to be called "Fraunhofer lines" from their discoverer. There were a good many, but he named the principal ones A, B, C, D, etc., after the first letters of the alphabet. Most of these lines could be found only in direct or reflected sunlight, though some of them, he discovered, were also in the light from certain stars. A lime light or a piece of white-hot iron gave none. It was also discovered that if you salted the wick of an alcohol lamp, quite another kind of effect was produced by its flame. Only one image of the slit was formed, and the spectrum (a discontinuous spectrum), 4, Fig. 23 (which appeared to be in exactly the same part of the spectrum as the black line, D, in the sun), was reduced to a single yellow line. Brewster observed that new dark lines appeared when the sun was near the horizon, but very little else was added to our knowledge till the time of Kirchhoff and Bunsen's "Memoir," which was the most important in the history of the subject, and which appeared in the "Transactions of the Berlin Academy" for 1861.

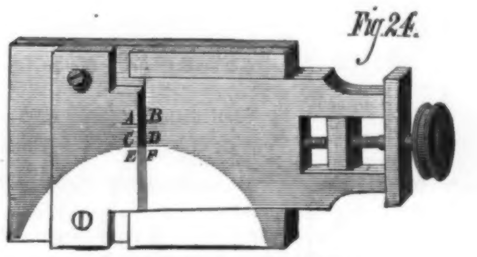
With the apparatus drawn in Fig. 21, they not only made a map of the spectrum of wonderful completeness for the time, containing over a thousand lines, but they showed what these lines, or rather gaps, in the spectrum were, and how they were formed in the sun. Taking the salted wick, or, better, the Bunsen burner, in which sodium was burned, to give the discontinuous spectrum of one yellow line, 4, Fig. 23, they showed that when any very brilliant light, like the lime light, was brought behind the flame so as to form a continuous spectrum the yellow flame would let the blue or red components of the bright light pass through it, but would stop out the yellow of its own tint, being transparent to other gradations, but opaque to this. In the spectrum formed by both lights together, the yellow line really exists, nearly unchanged, brighter if anything than before, but surrounded by so much greater brightness that it seemed black by comparison. This is a particular case of Kirchhoff's general law that all heated bodies absorb the same rays which they emit. Kirchhoff showed that not only sodium, but a great many other metals behaved in this way, and that a large part, at any rate, of the lines in his map were exactly coincident with those given by iron, barium, magnesium, etc. His proof that these metals exist in the sun is the immense improbability of such a number of exact coincidences being the result of accident. Thus, many hundred coincidences exist in the case of iron, which, burned in electrodes before the slit of the spectroscope, gives a discontinuous spectrum of many hundred bright lines. Kirchhoff remarks that in a certain portion of the spectrum 60 of these lines were found to occupy the same positions with as many dark solar ones, and that hence, by a known rule, the probability that this is mere chance is at any rate less than $(\frac{1}{2})^{60}$; in other words, that the chances are more than one million of millions of millions against its being accident. As he made his dark lines at pleasure in the laboratory by passing an intenser light from behind, through hot metallic vapors, he concludes that nature proceeds in a like way to like effects, in her great laboratory of the sun. The sun, he supposes, in other words, to have a solid or liquid nucleus, very hot and bright, which emits white light, containing every shade of color, and which of itself would give a continuous spectrum; but that around this is an atmosphere of cooler though still glowing metallic vapors, each of which by itself would give a discontinuous spectrum. Each of these vapors, then, gives an actually bright image of the slit, which simply appears black in the spectrum by contrast with the greater brilliance of the background. We now know that it is not necessary to suppose either a liquid or solid background, but with this slight emendation Kirchhoff's theory is still trustworthy.

Since his "Memoir" was published we have discovered a good many more substances in the sun's photosphere. The list now embraces aluminum, calcium, cobalt, magnesium, iron, zinc, barium, chromium, hydrogen, manganese, sodium, and a considerable number of whose existence we are less sure, and there are others in the shell of cooler vapors surrounding the white photosphere. When, in a total eclipse, the passing moon just hides the body of the sun, and before it has hidden the shell, this shell should, according to our theory, form a spectrum of bright lines only, and this is what has been actually observed by Professor Young and others. During a second or two, after the moon has hidden the bright background, and before it has covered the reversing layer as it is called, nearly every line in the spectrum is reproduced, standing separately as a colored image of the slit, those which ordinarily appear black on a red background being now crimson, those in the green portion, green, and so on—a beautiful but fleeting sight, which lasts only one or two seconds. In an extremely transparent atmosphere traces of this reversing layer (which is merely the densest portion of the thick stratum called the chromosphere) can be seen without an eclipse, and in fact at all times we can see many of the bright lines given from the chromosphere through the spectroscope when the telescope shows nothing. The chromosphere is always there, but, being composed chiefly of hot hydrogen and other gases or vapors which give far less light than the body of the sun, these are not hidden, but overpowered by it, as a candle flame would be beside an electric light. It is easy to see, though (once it has been done), how the spectroscope shows them. The hydrogen, for instance, shines chiefly by light of one color, a very beautiful crimson. If an image of the edge of the sun is caused to fall on the slit, so that the hydrogen light only enters, this, according to what has been said, passes through without being spread out or diluted by its passage through the prism, and comes through that to the eye as strong as where it falls on the slit. The white sunlight, however, if it enter beside the hydrogen rays, is pulled out into a long spectrum, and being spread, in a large instrument, over many thousand times the surface the other occupies, is proportionately diluted. The light which comes



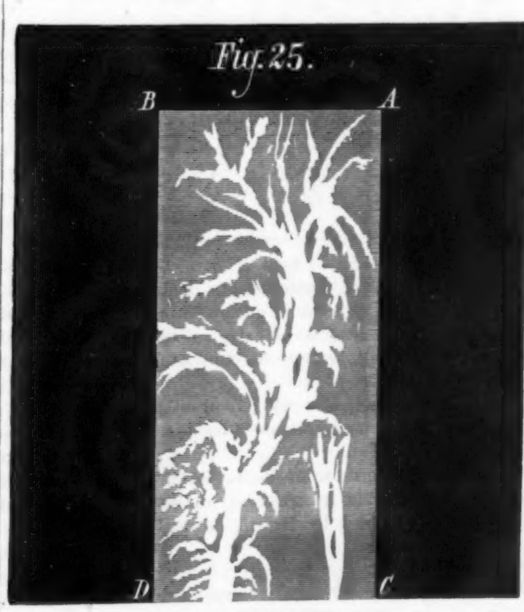
SLIT AND SPECTRA.

through an aperture, perhaps a hundredth of an inch wide, has thus been photographed by Mr. Rutherfurd in a picture ten feet long, every part of which is filled with dark lines. As there are 120 inches in 10 feet, if we suppose the slit to be $\frac{1}{100}$ inch wide, the white light has thus been weakened 12,000 times; and if it were originally a thousand times brighter than the colored ray from the chromosphere, the latter, preserving all its original intensity where it reaches the eye, would now be twelve times as bright as that which was at first so much stronger. Let A B C D E, Fig. 24, be a view of the slit placed so that its upper half, A B C D, is



EDGE OF SUN ON SLIT.

in the image of the chromosphere, its lower, C D E F, in that of the sun. In this figure we suppose ourselves to be standing in front of the instrument, looking at it. Evidently only light from outside the sun can pass through the upper part of the slit, but from our position we can see nothing but the bright round solar image formed by the telescope. The chromosphere is really there also, but overpowered by the bright sun, and invisible. Now let us suppose ourselves, Fig. 25, to look through the spectroscope, A B C D, being the same upper part of the same slit in the same position, but greatly magnified by the viewing telescope, which we



SOLAR PROTUBERANCE.

Scale of 60,000 miles to the inch.

here suppose to have an erecting eyepiece. The lower part of the slit, at E F, is lost to view, being pulled out into the spectrum along the line C D, which now forms its upper boundary, and extends right and left far beyond the limits of the actual engraving. The upper part of the slit is thus seen like an open window, through which we are looking at the chromosphere, now plainly visible. One of its many beautiful forms (from a drawing taken from nature) is supposed to be in view.

We have no room to describe how certain lines in the spectrum are known to be formed by absorption in our own atmosphere, and distinguished from solar ones, and we are obliged to leave untouched the use of our instrument for measuring the velocity of solar storms.

Before the chapter is closed, however, we must mention the latest form of the spectroscope, in which the prism disappears altogether. Almost every one has noticed the colors on mother-of-pearl, and any one with a microscope may have noticed that these are formed by numerous fine lines, invisibly fine to the naked eye, traced there by the hand of nature. In mathematical optics it is fully explained why colors must be caused by the lines, and it occurred to Fraunhofer to produce these artificially, drawing lines on glass with a diamond by means of a ruling engine and micrometer screw. In this way he succeeded in producing a spectrum so pure that many of the solar lines could be seen in it as in that from a prism.

More recently Mr. Rutherfurd has constructed an engine of wonderful accuracy, and has ruled such groups of lines on speculum metal with a precision almost beyond belief. Fig. 25 is the full size of the ruled part of one of these, containing numerous lines, disposed as in the engraving, but so close that over one hundred lie side by side within the thickness of one of the lines of the woodcut. The beauty of the spectrum it will produce, however, depends much more on the accuracy of the spacing, even, than on the fineness, and it can be shown that, though some lines may be more and some less out of place, the mean error of position to produce the effect they actually do must be less than one six-hundred-millionth of an inch, a quantity almost incredibly small, small even by comparison with the length of a wave of light, and far beyond the reach of the most powerful microscope. The microscope ceases to be of any use, in fact, in detecting the errors of the micrometer screw by which they are cut, and these errors can only be tested optically by the spectrum formed after the ruling is complete. It only remains to add, of this wonder of mechanical skill, that the little plate of metal, which can be hidden in the hand, is equal, optically, to the most powerful train of prisms yet constructed, and that these "gratings," for most researches on the sun, appear to be displacing all older forms of the spectroscope.

Dr. August H. Petermann, Ph.D., D.D.

Dr. Petermann, the well known German geographer, suffered a stroke of apoplexy, September 27, and died at Gotha, the same day. The New York *Tribune* sums up his scientific labors as follows:

He was born in 1822 at Bleicherode, near Nordhausen, in the Prussian Province of Saxony. He was educated at Nordhausen with the view of entering the Church, but, showing a decided preference for the study of geography, he was transferred in 1839 to the Royal School at Potsdam, of which Professor Berghaus, the eminent scientist, was director. Here the young student remained six years as private secretary and librarian to Berghaus, who was then engaged on his great "Physical Atlas." During this time Petermann became acquainted with many eminent men, including Humboldt, for whom in 1841 he drew a map to illustrate his travels in Central Asia. In 1845, Petermann went to Edinburgh, where for two years he assisted A. K. Johnston in preparing an atlas with English names corresponding to that on which he had been engaged at Potsdam. This work completed, he went to London, where he published, in conjunction with the Rev. Thomas Milner, an "Atlas of Physical Geography." He also wrote an account of Central Africa, based on recent explorations. The interest in penetrating the mysteries of the Dark Continent was very great, and through his exertions Government aid was given to the explorers, Barth, Overweg, and Vogel, of whose progress he kept the public informed through the pages of the *Athenæum*. He also contributed to the "Encyclopedia Britannica," and to the geographical division of the English Cyclopedia.

In 1854, Petermann became Professor of Geography at the University of Gotha, and in 1855 received from that in Göttingen the degree of Doctor of Philosophy. He thenceforth resided in Gotha, where he was also employed in superintending the large establishment of Justes Perthes, the great map publisher. He likewise edited for the same house a monthly periodical containing maps, charts, and communications relative to all important discoveries in geography. In 1876 Dr. Petermann came to this country to see the Exhibition. The Geographical Society held a special meeting to receive him, in company with the Emperor of Brazil and Dr. Berendt, the Central American ethnologist. His speech on this occasion showed that he was a warm friend of this country, which, he observed, was in the van of human progress. One of the last incidents of his life was to give his views last June, to a newspaper correspondent, on Arctic explorations, a subject which he had studied with unremitting earnestness. He felt certain that the North Pole would some day be reached, and was convinced that the route by Behring's Straits, or by the eastern coast of Greenland, are the ways by which the Pole is to be gained. "Now," he said, "that the Congo and Nile sources have been settled, this is the one great thing to be done." In a general way Petermann's services to geographical science are great and lasting. He codified, as it were, explorers' observations, recording with his pencil the

mariner's track in the Arctic seas or the traveler's pathway in the African deserts. Earnest and enlightened, he was in sympathy with every enterprise calculated to extend the sphere of knowledge and make known the wonders of this terrestrial globe.

Correspondence.

Bed-bug Spiders.

To the Editor of the Scientific American :

Perhaps there are not very many aware of the great utility of at least one species of the common house spider as a destroyer of bed-bugs. The latter became introduced into my house (a new one) in a child's bedstead bought at a sale. I tried all possible means to exterminate them, but seemingly without effect, as they had got into the walls and extended to different rooms. One day I noticed what I thought to be a very large bed-bug carrying off a very small spider of about half its size. This I was determined to prevent, and went with a small piece of stick to separate and kill the former. They first ran very lively along the floor in opposite directions, but to my great surprise I saw the little spider wheel around, pursue, seize, and bear off the bug in triumph with great ease. A further search revealed one day a spider's web in which hung about half a dozen dead bugs like carcasses in a butcher's stall, for the spider, who generally depends on his net for securing his prey, had apparently on this occasion left it for so precious a morsel. I forthwith gave directions that no spider's web was to be brushed down for a time, much preferring the remedy in this case to the bugs; and whether it was that the spiders had the best of them I cannot say, but the result was that in a little while they became totally extinct.

There is another species of the spider, numerous but very seldom seen, which does not make webs, but pounces on its prey, and lives in crevices. It is harmless, one of the least repugnant looking, but one of the most extraordinarily active little customers in the insect creation. If it were found that "bug" was "venison" to that spider, and it could be introduced into houses, the former might make their wills.

London, Canada. H. TAYLOR.

Pocket Life Buoys.

To the Editor of the Scientific American:

If you will turn to patent 679, issued to me April 7, 1838, you will find described under the above caption your desideratum, namely, "A circlet of waterproof cells, each provided with an automatic valve so as to be easily inflated, and yet all so independent of each other that the bursting of one would not affect the rest," with the addition of a bellows to inflate it, itself forming another air chamber, isolated likewise from the others.

I took to Charles Goodyear, who had on June 17th preceding obtained a patent "for divesting caoutchouc of adhesive properties," orders from responsible firms, one in New York for 2,000 and another in Philadelphia for 1,000 of this "safety life preserver," with the assurance of yet another in New Orleans for an additional supply.

Goodyear was even then in the hands of brokers who had him mortgaged ahead, and his necessities perhaps caused him to fail in delivering a proper article, and to disgust the parties by premature drafts upon them. The matter therefore was dropped; but I cannot at all doubt that all the conditions required in your paper would have been met. As a nation is not born in a day, neither is an invention perfected at once. In the Philadelphia City Directory for 1839 a woodcut of the advertiser represents the article in an improved form, but my expectation was to furnish it eventually of so thin a material that it could be carried in a pocket case, and be reliable in the hour of danger by the number of independent chambers inflated from the bellows. This latter appliance pleased Goodyear much, and he proposed using it for his gum elastic bed and other similar articles.

I had known Charles Goodyear long before, when, in this city, he and his father made his patent pitchforks—an invention that should and could have made him rich had he kept to it. I now found them plodding on in the old manner—the one making rubber cloth in a small frame building near Boston, the other with something like the wealth of the Indies mentally almost in his grasp—alas! his head could produce, but his hands could never reach it.

J. J. WHITE.

Labor Saving Farm Machinery.

To the Editor of the Scientific American :

It is not always that the poison and antidote come to hand together; but the other day the news came along the wire under the ocean that the Communists of the West had declared against labor-saving machines, especially the automatic binding reaper. About the same time M. Tisserand, the Director General of Agriculture, a gentleman who had charge of the government farms under the empire, and retains the same position now by virtue of his thorough acquaintance with the subject, handed me the inclosed statement. It may be remarked, in passing, what a fearful comment it is on republican institutions that he was not at once put out and some party worker put in. But these French seem to be behind the age.

The statement is the most compact exemplification of what high and systematic farming will do for labor and trade; and though it does not include, which I regret, the figures of return for labor and money expended, I am informed that the balance sheet on this side is most satisfactory.

Those who scowl at the employment of machinery and scientific method will doubtless approve of the pasture farm with its man and a boy at $200 a year; but those who wish to see a country prosper may prefer that the same land may be cultivated by a method which will pay $7,000 in wages, and encourage the importer and manufacturer of fertilizers to the tune of $6,000 per annum.

Statement of high farming in East Lothian, from a visit in 1868, when the late Mr. George Hope gave this account of Fenton Barns Farm, 700 imperial acres, or 430 Irish acres.

Acres (English) in	Potatoes.	Beans and Vetches.	Turnips.	Wheat.	Barley.	Oats.	Rye Grass and Clover.	1 year old Pasture.	2 years old Pasture.	Turnip Seed.	Feeding Stock. Bull.	Breeding Cows.	Bullocks and Heifers.	Leicester Sheep.	Cheviot Sheep.
1866	83	38	88	126	88	54	21	85	50	13	1	17	80	300	400
1867	61	41	113	141	70	63	18	68	73	0	1	17	100	600	250

Consumed on Farm. Ton = 2,240 lbs.

Corn and Oil-Cake.	Grain.	Peruvian Guano.	Super Phosphate.	Nitrate of Soda.	Lime.
Tons.	Bushels.	Tons.	Tons.	Tons.	Tons.
100	1,600	48	40	6	70

Employed on Farm.

Steam Plow.	Plows.	Farm Horses.	Steward	Shepherd	Men.	Women and Boys.	Wages per Acre.	Manures per Acre.
1	13	20	1	1	19	40	£2.0.0	£1.10.0

Mr. Handyside's farm, of Fenton Diern, is similarly managed, and is of about the same extent. It has about ¼ potatoes and turnips, ⅜ grain, and ⅜ one and two year old grass; only 3 acres permanent grass on each. Wages of each farm about £1,400, sterling, per annum. Cost of manures, £1,200 to £1,300 per year.

A grass farm in Ireland would pay in wages about £30 or £40 a year, giving no employment except to a herdsman and a boy.

These farms, and those of Badhoeve in Haarlem-Meer, Holland, owned by Mr. Amersfoordt, and the farm of Rathelly in Ireland, owned by Mr. F. Barber, are the model farms of the world.

Such an account is absolutely unanswerable, except by a disproof of the figures, which is challenged.

EDWARD H. KNIGHT.

Paris, September, 1878.

Heathen Japan.

Professor Edward L. Morse, who holds a professorship in the University at Yeddo, a city of 1,000,000 people, is now in this country. He recently delivered a lecture on the manners and customs of that people, in which he alluded to their careful treatment of children, the invariable cleanliness of their houses, resulting in the entire absence of diseases such as scarlet fever, diphtheria, and other afflictions so common in this country. The people are of gentle manners and particularly kind and careful of their animals. During his residence there he never heard a cross word uttered by a native, saw no fighting, and heard no profanity.

New Inventions.

An improved Suspension Arm for Sleeping Car Berths has been patented by Mr. John R. Fish, of Grand Rapids, Mich. The object of this invention is to provide a simple and convenient means for fastening or locking the joints of the swinging arms which support the berths in sleeping cars, whereby the joint is made rigid after the berth is prepared for use, and the berth is prevented from closing in case the car tips over.

Mr. Hiram Snider, of Plattsville, Ontario, Canada, has devised an improved Automatic Weighing Apparatus, which may be attached to the delivery spouts of flour mills, for the purpose of weighing the grain, flour, bran, and other products as they are delivered, and registering the weight. By this apparatus the gross product of a quantity of grain when ground may be ascertained, or the weight of the flour, bran, and middlings may be found separately, and a miller can ascertain without trouble the exact yield of a given quantity of grain.

Messrs. James Dunseith and Samuel Crawford, of New York City, have patented an improved Water Heating Attachment for Stovepipes, which is so constructed as not to interfere with the draught of the stove, while utilizing the heat that may be passing off through the pipe for heating water, making coffee, or other purposes.

Mr. Hermann Lingen, of Wheeling, W. Va., has patented an improved Measuring Jacket, which is similar in form to the body of a frock coat, having its seams united by elastic cords, to permit them to open more or less to allow the jacket to conform itself to the shape of the body of the person being measured. The elastic seam lacing cords are provided with hooks, which may be adjusted from one eyelet to another. Flaps are placed behind the seams to receive chalk marks, and the jacket is provided with suitable pads.

Messrs. Joseph W. Trudell and Louis S. Trudell, of Sioux City, Iowa, have patented an improved Coupling for connecting the parts of the front gear of a wagon in such a way that they may play easily upon each other, and at the same time may be held securely in place.

Mr. Thomas Stumm, of Ada, Ohio, has patented an improved Washing Machine. This invention relates to certain improvements in that class of washing machines covered by letters patent granted to the same inventor May 5, 1874, No. 150,494, and February 16, 1875, No. 159,855.

An improved Ear Ring Cover has been patented by Mr. Anthony Hessels, of New York City. This invention refers to improvements in that class of ear rings in which an outer shell or covering is used to inclose a diamond or other valuable stone whenever it is not desired to expose the same to view. It consists of a cover or shell having a bottom opening for inserting the diamond or other stone, a slit extending from the opening to the top or apex of the shell, and a gravity drop plate at the inside for closing the bottom opening of the shell.

Mr. Benton Elliott, of Ellsworth, Wis., has patented an improved Holder for Strings used in tying packages or bags, and for holding shoe strings, so that one at a time may be removed from a bunch without snarling those that remain.

An improved Ore Separator has been patented by Mr. Emory B. Hastings, of Palmer, Mass. The object of this invention is to furnish a machine for separating ores, or similar uses, for treating finer and coarser particles with the same facility. It may be easily adjusted to operate upon different grades, is simple in construction, and easily operated.

Mr. Theodore Miner, of Brooklyn, N. Y., has devised an improved Carbureter, which feeds the naphtha automatically to the carbureting chambers as it may be required, and will introduce the gas into the warmer part of the carbureting chambers and withdraw it from the colder part.

Mr. Daniel K. Wertman, of Mount Carmel, Pa., has patented an improved Harness, which consists in a novel arrangement of thill straps, a hip strap, and a pad, whereby the weight and pressure are distributed more uniformly over the body of the horse, and greater freedom of motion is permitted than by the employment of the breeching heretofore in common use.

Mr. Thomas C. Smith, of Greenpoint, N. Y., has devised an improved Ice Pitcher, which is so made that as large a piece of ice can pass in through its mouth as its body will hold, and it is provided with a device which will prevent the ice from being poured out with the water.

Mr. Joseph M. Kurtz, of Weston, Mo., has recently patented an improvement in Glazier's Square and Rule. This invention consists in a rule having inches and parts of inches marked upon it, and provided with an arm at a right angle, to form a square. The rule or base has an extension slide at one end, which may be clamped in position, and it is also provided with a movable guide, which may be clamped at any point on the rule, and forms a stop for the glass, while the arm of the square serves as a straight edge along which the cut is made.

An improved Shirt has been patented by Mr. Edward H. Inglis, of Newtown, N. Y. This shirt has two bosoms or fronts, that may be readily shifted when desired, so that when one front becomes soiled it may be replaced by the

other Besides the advantage of having a clean bosom when one becomes soiled, the shirt having this improvement affords protection to the chest at the most exposed part.

Mr. David H. Thomas, of New York City, has patented an improvement in Cooking Ranges, which consists in a novel arrangement of the flues and ovens; also in a sectional swinging grate and a blower or grate cover for broiling.

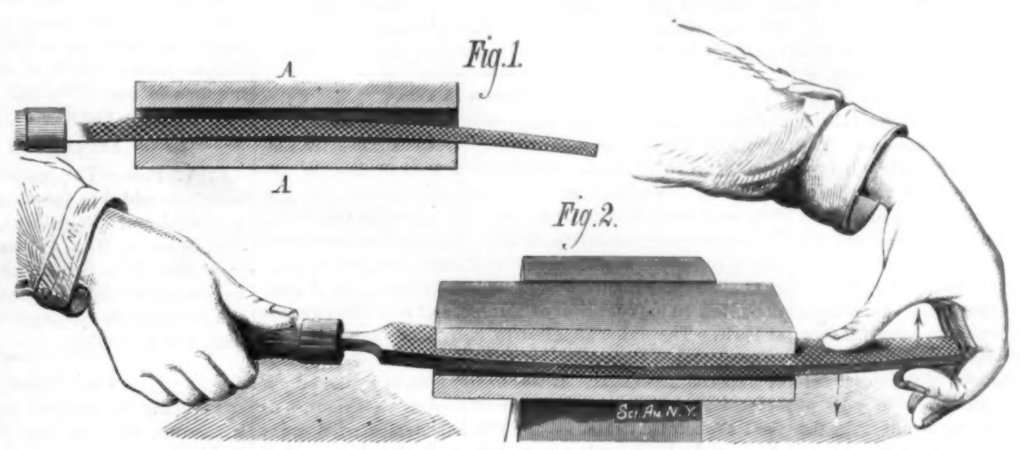
Mr. Henry V. Aiken, of Fishkill Landing, N. Y., has patented an improved Pneumatic Gong Pull, which is so constructed that the gong hammer may be operated by means of compressed air. It may be used upon vessels, in houses, and in other places where signals are to be given.

Mr Jerome F. Busey, of Peck's Mills, Pa., has devised an improved Machine for Bending Chain Links, which may be adjusted so as to produce links of different sizes and thicknesses of iron by one and the same machine, without necessitating the use of several machines for each size of link.

A WRINKLE IN FILING.

Those who have used slender files have met with the difficulty that the file bends from the pressure with which it must be forced upon the work to make it cut The result is that it files the edges of the work away, leaving the surface rounding, as shown in Fig. 1, in which A A represents the operation of filing out a narrow keyway, the file bending from the pressure, as shown, rendering it necessary to either make a drift to finish the keyway with or to work out the roundness with the end of the file only, which is a long and tedious job

To remedy this defect and enable the filing to be done with full strokes and a maximum of pressure, the file may be grasped as shown in Fig. 2. The pressure of the forefinger and thumb, being exerted in the direction denoted by the respective arrows, bends the file to a sweep or curve, causing it to file flat clear across the work, while if any particular part only requires to be filed the file may be brought to bear against it and short strokes taken. It is obvious that in this case the handle end of the file must be elevated or depressed to bring the belly of the file to bear upon the required spot. J. R.



A WRINKLE IN FILING.

Chrysoline on Cotton.

The author has been commissioned to examine the applications to cotton of a new coloring matter known as chrysoline, and which, since March, 1877, has been used in wool and silk dyeing. It is the soda salt of benzylated fluorescine, and has been discovered and manufactured by M. Fred Reverdin.

As the inventor has himself in several publications described the chief properties of the new product, and the method of its preparation on the large scale, it will merely be necessary to describe here its characteristic reactions.

This color is soluble in all proportions in water and alcohol. In glycerine diluted with water it is less soluble, and in concentrated glycerine it dissolves only with the aid of heat. It is insoluble in oils. Essence of turpentine precipitates it from its aqueous solutions.

Its solutions by reflected light are of a splendid green color, but by transmitted light of an orange

Alkalies promote its solution, while the acids and all the metallic salts, except the carbonates, give an orange precipitate, the shade of which varies according to the base of the salt.

Among these precipitates, the most remarkable are those given by chloride of tin and nitrate of lead. The latter is brightest if we precipitate a cold, weak solution, which has previously been rendered slightly alkaline

Chrysoline contains two distinct coloring matters—the one gives a yellow precipitate with acids and metallic salts, the other a red or rose precipitate with salts of lead.

The latter color is not fast; the former is more stable. If the precipitate produced by muriate of tin is allowed to settle, the clear liquid above is of a light orange. If this is rendered ammoniacal, and mixed with a weak solution of nitrate of lead, it deposits a splendid rose-colored precipitate, apparently due to the presence of a certain quantity of eosine, which is produced in the manufacture along with the yellow color.

Cotton cannot be dyed in a direct manner with chrysoline, and receives only a slight rose coloration if previously mordanted with salts of iron or alumina.

With a lead mordant it takes a beautiful light rose, the shade of which is scarcely proportionate to the total quantity of chrysoline in the dye bath. It is the red coloring matter alone above mentioned which dyes. The whites are always stained.

If cotton is worked in a watery solution of chrysoline, 1 grain to the fluid ounce, and dried, it takes a very fine orange shade. This color, which is characteristic of chrysoline, is not fixed upon the cotton, and is very sensitive to light. A few hours of exposure cause it to fade and even to disappear.

If this colored cotton is passed before drying into a bath of oil mordant, a part of the yellow color is fixed well enough to resist simple washing.

A weak solution of nitrate of lead likewise fixes the coloring matter with an orange shade, in which the influence of the red coloring matter may be traced.

Cotton previously prepared with an oil mordant exhausts the color bath and dyes up a full orange. This color resists light better, but does not wash.

Printing.—After these preliminary trials I endeavored to apply chrysoline in printing.

A solution of 1 grain per fluid ounce of water, thickened with egg albumen, gives a fine yellow, which, after steaming, is sufficiently intense. Washing removes much of the yellow, and there remains merely a dull faded color.

A better result is obtained by printing with precipitates containing 62 grains of chrysoline in 31 ozs. of color. I exhibit two such precipitates applied with albumen; the one obtained with nitrate of lead, and the other with muriate of tin.

These precipitates were obtained as follows: 17½ fluid ozs. of solution containing 15 grains of chrysoline. This is slowly precipitated in the cold, with ⅛ oz. of a solution of nitrate of lead, or of tin crystals, containing 3⅛ ozs. per 1¾ pint. The precipitate is washed twice by decantation. 5½ fluid ozs. of this precipitate are thickened with 2½ ozs. of egg albumen. The lead color, though the more beautiful, must be given up, as it becomes discolored on steaming and exposure to the air. The tin color, on the other hand, is of a very fine orange, and is developed by steaming, and resists light better.

The two colors are much degraded and changed in tone by a slight soaping. They present then a flesh color, which is restored to a yellow by acids.

There is still a third method of application, that with arsenite of alumina. Upon calico prepared with acetate of alumina there is printed a solution of chrysoline, 62 grains to 35 fluid ozs., containing the necessary quantity of arsenite of soda, and thickened with white starch. The results are better as regards solidity, but at the expense of beauty. The orange is less intense, more of a yellow shade, and wanting in brightness. It resists washing and light.

Dyeing.—I submit some skeins dyed upon the same principles. The results are not much more satisfactory. The first skein was mordanted in acetate of alumina, at 5° B., steeped in a bath of chrysoline and arsenite of soda, wrung, dried, steamed, and washed. A tolerable orange, which resists light slightly.

The second skein, prepared in the same manner, was then dyed in a bath containing acetate of alumina and arsenious acid dissolved in glycerine. Wring, dry, steam, and wash. The tone is much more yellow.

Caution must be used in this process, as it is difficult to get the threads evenly dyed.

The third skein was saturated with a solution of chrysoline, dried, and passed into nitrate of lead. The result is a fine orange, but not solid.

The fourth skein shows the color fixed with muriate of tin, the tone being slightly less red than the foregoing. All the shades obtained with chrysoline are rendered yellow by acids, and are restored to their primitive shade by alkalies.

I have still to relate a fact which has been already remarked with other artificial coloring matters. A yellow dyed with bark is considerably heightened by taking it through a weak solution of chrysoline, 1 grain to the fluid ounce.

Chrysoline, therefore, cannot be considered applicable to cotton where nitroalizarine may be advantageously used in its stead. This latter color gives shades more solid, and almost as brilliant.

Chrysoline will find its use for wool and silk, which it dyes readily without mordants, and on which it is much more solid.—*Société Indust. de Rouen.—Chemical Review.*

A Cheap Illuminated Clock.

Reiniger, ot Stuttgart, proposes an ingenious substitute for illuminated tower clocks. It is the use of a magic lantern, so frequently employed for street advertising in this city. A small lantern could be so arranged as to throw the picture of a common watch or chronometer upon a suitable white screen in places much frequented at night. The movements of the hands would be quite as distinct as those of a real clock with a transparent face and a strong light behind it. The project recommends itself to smaller cities, unable to bear the expense of a costly tower clock with illuminated face.

New Mechanical Inventions.

Mr. Edmund Golucke, of Crawfordville, Ga., has patented an improvement in stationary Horse Powers employed for driving cotton gin machinery; and it pertains particularly to the construction of the king post and master wheel and their appendages.

Mr. John W. Donnel, of Muscatine, Iowa, has patented an improved Millstone Driver, in which the driving points and the point of suspension are in the same plane and parallel with the face of the runner. By this construction the extra pressure on the skirt of the stone is avoided. The driving block is supported on the shoulder of the spindle a sufficient distance below the cockeye, so that it may vibrate and balance itself easily.

An improved Hoisting Jack has been patented by Mr. Richard O. Keeffe, of Omaha, Neb. The object of this invention is to furnish an improved hoisting jack for raising railroad tracks, safes, and other heavy bodies that require to be taken hold of close to the ground or floor.

Mr. Ramon Verea, of New York City, has patented an improved Calculating Machine. This ingenious machine is capable of rapidly performing addition, subtraction, multiplication, and division. The details of its construction cannot be properly described without engravings.

Mr. William Booth, of Newark, N. J., has patented an improved Machine for Rounding Off the Ends of Fine Combs, such as are made of celluloid, hard rubber, and other material, the machine being adapted for cutting different sizes of combs, and accomplishing its work rapidly and accurately.

Mr. Arthur Sirois, of New York City, has devised an improved Coupling for the driving belts of heavy machinery, and also for the driving cords of lighter machinery, such as sewing machines, etc., the coupling admitting of the instant connecting or disconnecting of the belts or cords, while taking up a small space, so as not to interfere with the driving of the pulleys or wheels.

Mr. William H. Peterson, of Richmond, Ind., has patented an improved Double Acting Force Pump, that is of simple and compact form, and adapted to be placed at any depth in the well, so as to make it non-freezing.

An improvement in Machines for Cleaning and Polishing Coffee has been patented by Mr. Henry Bamberger, of Philadelphia, Pa. This invention has reference to an improved machine for cleaning coffee of its adhering impurities, dry hulls, etc., and imparting to it a smooth and uniform appearance.

Mr. Willie Kniffin, of Yorktown, N. Y., has patented an improved Lifting Jack for raising the axles of wagons to allow their wheels to be removed, and to raise other heavy weights. It is so constructed as to enable a weight to be raised by a slight exertion, and will hold the weight suspended for any length of time.

Mr. William H. Walsh, of Fort Worth, Texas, has devised an improved Gin Saw Sharpener, of simple construction, by which the teeth of the saws are cut square at the inside and pointed at the top, and by which the sharpening of all the saws of a cylinder is accomplished quickly and perfectly, avoiding the objectionable features of hand sharpening.

Sedgwick M. Wade, of Andover, Ohio, has patented a Strap Hinge, composed of two leaves, having flanges and rear tongues, the latter curved to form sockets for the pivot.

Effect of Gas on Cotton Goods.

At the last meeting of the Chemical Section of the Philosophical Society of Glasgow, Dr. William Wallace, gas examiner and public analyst for the city of Glasgow, read a short paper on the destruction of the color of cotton goods by the sulphur in the gas burned in the London warehouses. Sulphuric acid, he said, was found in considerable quantity in the goods after being some time exposed, while the same articles in the fresh condition were quite free from that acid. In some cases the cotton fiber itself was rendered so tender as to be perfectly useless. The same thing had been observed in the warehouses in several large towns in England, such as Leeds, Manchester, etc., where common coal, containing much sulphur, was used as the source of the gas supplied to the consumers, but only to a limited extent. The remedy which was recommended by Dr. Wallace was the thorough ventilation of the warehouses, so as to insure that the sulphurous and sulphuric acids generated by the burning of the

gas might have a sufficiently free escape into the atmosphere. He also suggested the free use of lime for whitewashing the walls of the warehouses, so that the acid vapors floating in the more or less confined air might combine with the lime. He exhibited a number of specimens of the goods which he had examined after they had been sent back by the London merchants, as damaged, to the manufacturers. Both in color and in strength they were seen to have suffered detriment by exposure to gaseous fumes.

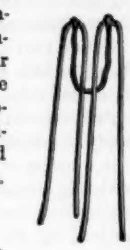
IMPROVED STEAM FIRE ENGINE.

Our engraving represents one of the improved steam fire engines that have been supplied for the new chief station in the Southwark Bridge road of the Metropolitan Fire Brigade, London. The object of Captain Shaw in the construction of these machines has been to keep all the parts as light as possible, consistent with the necessary strength, so as to enable the firemen, with all their apparatus, to be conveyed quickly to a fire. To ascertain the required strength of carriage wheels, etc., Captain Shaw recently instituted a number of experiments at the vacant ground on the Thames Embankment, near Blackfriars Bridge, where the engines were tried in every possible way, and the information obtained by means of these experiments has been employed in the design of the two engines in question.

Hitherto the consumption of a considerable quantity of gas has been found necessary in order to keep up the temperature of the water in the boiler. This is now avoided by an improvement introduced by Messrs. Shand, Mason & Co., into their inclined water tube boiler, consisting mainly of an increase of the heating surface, the quantity of the water remaining the same. By this the time required for raising steam is reduced by between two or three minutes. The engine is of the makers' well known single cylinder type with bucket and plunger pump. The vertical and rotary parts are evenly balanced, so that the transverse oscillation previously noticeable has been entirely overcome, and the engine works at high speed with great regularity. The valve passages in the pump have also been enlarged, and the steam used more expansively, so that weight for weight the engine is rendered about one third more powerful than those previously in use. By these means, and without increasing the weight of the boiler, the area of the steam cylinder has been largely added to, so as to enable a jet of water to be thrown to the increased height required by the great extension of lofty buildings in London. A novel form of self-acting by-pass has been adopted, which can be adjusted so that the whole or any part of the water pumped is returned to the suction chamber, enabling the fireman directing the jet to control it completely without sending messages to the engine driver. An engine of this kind forms part of Messrs. Shand, Mason & Co.'s exhibits in the Paris Exhibition. We take our illustration from the *Engineer*.

Improved Hair Pin.

Mr. Edward Kelly, of Baby's Point, Ontario, Canada, has recently patented an improvement in hair pins which is clearly shown in the accompanying engraving. The improvement consists in connecting two or more ordinary hair pins by means of an elastic cord of suitable length, so that the pins may be inserted on opposite sides of hair braids with the elastic connection passing over the top. The cord contracts and securely holds the pins in place.



Large Driving Belts.

At the Paris Exhibition, some fine main driving belts, made after Sampson's patent, are shown by Mr. Edwards, of Manchester, Eng. There is one double belt, 207 feet long, 63 inches wide, which weighs 2,962 lbs., and is made to transmit 600 indicated horse power. Another is 184 feet long, 53 inches wide, while a third is 163 feet long and 63 inches wide. These two latter weigh together 4,378 lbs., are without cross joints from end to end, and are intended for a large cotton mill, to drive direct a flywheel 30 feet in diameter, and 10 feet 3 inches on the face. The combined horse power they are made to transmit is 1,000.

American Cotton at Paris.

Colonel Balys, special commissioner from Tennessee to the Paris Exhibition, reports that Memphis not only won the leading prize for the exhibition of the best bale of cotton, but also received a grand testimonial, the bale which it displayed being said to be the best ever raised in the world. Its history is somewhat remarkable. At an exhibition in Memphis it received the grand prize of $1,000, another first prize at the Centennial, a third at Liverpool, still another at a national fair on the continent of Europe, and now these awards at Paris. The value attached to it by its owner has been so great that in transportation abroad it has been in charge of a special messenger. It was finally bought by the largest spinner of lace goods in Paris to be kept as a souvenir. At the Philadelphia exhibition the Fiji Islanders carried away the prize for long staple cotton, but at Paris this year they gracefully yielded to Memphis. That Egyptian cotton, long staple, is to a certain extent competing with our sea island cotton is attributed to the fact that while the South has been favored with unusual crops, yet it has not been careful in their preparation, and consequently they have not yielded so high a price as they would have been otherwise entitled to.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, October 19, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Venus rises	5 18 mo.	Uranus rises	1 52 mo.
Mars rises	5 26 mo.	Neptune rises	5 49 eve.
Jupiter sets	10 52 eve.	Neptune in meridian	0 38 mo.
Saturn in meridian	10 01 eve.		

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	10 08 eve.	Procyon rises	11 20 eve.
Mira (var.) rises	8 32 eve.	Regulus rises	1 27 mo.
Algol (var.) rises	1 10 mo.	Spica rises	6 04 mo.
7 stars (Pleiades) rise	6 18 eve.	Arcturus sets	7 29 eve.
Aldebaran rises	7 37 eve.	Antares sets	6 49 eve.
Capella in meridian	3 17 mo.	Vega sets	1 36 mo.
Rigel rises	9 44 eve.	Altair in meridian	5 52 eve.
Betelgeuse rises	9 29 eve.	Deneb in meridian	6 44 eve.
Sirius rises	11 45 eve.	Fomalhaut in meridian	8 57 eve.

REMARKS.

Venus and Mars will be near the moon October 25, Venus being 7° and Mars 6° north of the moon. They are in *Virgo*, near the middle of the constellation, being 5° northwest of Spica. Jupiter and Saturn are the only planets visible to the naked eye, which are at present favorably situated for observation. Jupiter will be at eastern quadrature October 21, being then 90° east of the sun. Uranus will be in conjunction with the moon October 21, being about 3° north.

ANSWERS TO CORRESPONDENTS.

F. V. Pike.—The amplitudes of the three stars which have been added to the above list since the amplitudes were published are: Fomalhaut, 41° 41m. 30 sec.—; Deneb, 68° 30m. 20 sec.+; Mira, 4° 39m. 57 sec.—. Jupiter retrograded from May 25 to September 22. Inquirer.—We have never witnessed an eclipse of one of Jupiter's satellites by another, and do not think such a phenomenon has ever been recorded, though it is possible.

Two Crops of Silk a Year.

Touching the reported improvement in the breeding of silkworms, whereby two broods a year are raised, Mr. J. J. Hessler, of Reading, Pa., informs us that it is an old practice, at least one that he has followed for many years. He has been in the business from childhood, he writes, and has always raised two yields in a year without any trouble.

IMPROVED STEAM FIRE ENGINE.

HAIRY PREHENSILE-TAILED PORCUPINE.

The brightest, and prettiest, and by far the pleasantest of all of the places of resort within cab-fare radius, in London, is the northeast corner of Regent's Park. There are the Zoölogical Society's Gardens, where may be found a collection which, in some departments, is unsurpassed. This collection is continually being enlarged and improved.

Our illustration represents some interesting little animals that have lately made their appearance. The hairy porcupine with the prehensile tail, the tree porcupine of Brazil, whose Latin name is *Sphingurus villosus*, was obtained by purchase in March, 1877; but she gave birth to a youngster on July 9 of this year, and our engraving represents both mother and child. They have a lodging at present in the house belonging to the small mammalia, on the east side of the gardens; but the parent is apt to run up to the very top of the bough placed aslant in a corner, so as almost to hide herself beneath the roof. She is between a large rat and a small rabbit in size, and of a grayish-brown color; the tail is very useful, awake or asleep, for holding on to trees.

We take our illustration from the *London News*.

HAIRY PREHENSILE-TAILED PORCUPINE.

Fish Culture in New York.

The New York Commission of Fisheries report that more than three millions of shad fry were turned loose in the Hudson River, one million eight hundred thousand young salmon trout were distributed, and of the brook trout—the species in respect of which the burden of effort has been expended and the maximum of success in hatching reached—an immense number were hatched and placed in the various waters of the State. The orders for this succulent and gamesome fish far exceed the supply, and if even a small number reach maturity there is no reason why our larger trout streams should not recover the reputation which they had before they were depleted by the increase of our scientific anglers. The Commission are now occupied with new branches of fish culture of such a character as the supply of insect food for the finny gourmands and the crossing of breeds, all of which goes to prove that ere long the culture of fish will reach the point already attained in the propagation of animals, fruits, and plants. The Commission consists of ex-Governor Horatio Seymour, Mr. Edward M. Smith, and Mr. Robert B. Roosevelt.

GOLDEN BIRD OF PARADISE.

It is hardly possible to conceive a more singular arrangement of plumage than is presented in the Golden Bird of Paradise, although in many species there is something so remarkable and unexpected that we believe the extreme of uniqueness to have been reached until we come across another species which equally raises our wonder and admiration.

In this species six long slender shafts start from the head, three on each side, bare for the greater part of their length, and furnished with a little patch of web at their extremities. These curious shafts are movable, as the bird possesses the power of raising them so as to stand out horizontally on each side of the head, or of permitting them to hang loosely down the sides of the neck. The flanks are decorated with massive plumes of jetty black, that are also capable of being raised or lowered at the pleasure of the bird, and that fall over the wings and tail so as nearly to conceal them.

The general color of this curious species is deep velvety-black, changing into gray on the top of the head, and into the richest changeable golden green on the back of the neck. The throat is most gorgeous in the sunshine, being covered with scale-like feathers of glittering green edged with gold. The feathers of the tail are also velvet-like, and some of the shafts are long and filamentous. The total length of this bird is rather under a foot.

We take our illustration from Wood's "Natural History."

GOLDEN BIRD OF PARADISE.

A Destructive American White Ant.

A correspondent of the *Gardener's Monthly* having recently sent specimens and description of a white ant, which he found not only destroying his geranium plants but even eating through his pine plant stakes, the subject was referred to Rev. H. McCook, an eminent authority. This gentleman reports that the insect is our common *Termes flavipes*, which abounds everywhere in the vicinity of Philadelphia. He says: "I have traced them by myriads. Some time last winter I made a statement concerning these insects before the Academy, and exhibited the specimens of their work from my collection of insect architecture. They were taken from the fence of a gentleman in Delaware county. The surface of the wood was literally riddled by the termites. They love decayed wood, under which they rest, and on which they feed. They also live under stones.

"They have not been of great damage here as yet, but the possibility of such an increase of the insects as to make them pests is at least worth thinking about. Dr. Leidy has recently made some interesting discoveries of the parasite life within their abdomens—a wonderful revelation. *Termes flavipes* is not a true ant, but belongs to the *Neuroptera*."

Phosphorus a Cure for Sciatica.

It is not ordinarily wise to try remedies for effecting cures which one finds in the newspapers. But where the ingredients are such that no harm can arise from their trial, and the source from which the prescription emanates is likely to be reliable, the afflicted will gladly try almost any remedy recommended.

Dr. Volquardsen reports in Schmidt's *Dictionary* and the *Pesth Medico-Chirurg. Presse*, both good authorities, from which the London *Medical Record* copies, a case of sciatica which lasted for two years and defied all treatment. He then arrived at the idea of trying the internal use of phosphorus, which he prescribed in does of fifteen milligrammes (about one fourth of a grain) three times a day. Three days sufficed to obtain a marked improvement, and three weeks brought a complete cure.

Castor Oil Plant.

Originally a native of Asia, the castor oil plant is now naturalized in Africa, America, and the south of Europe. This plant has been known from the remotest ages; its seeds have been found in some Egyptian sarcophagi, supposed to have been at least 4,000 years old. It is singular that the oil expressed from its seeds should have been used by the ancients, including the Jews, as one of their pleasantest oils for burning, and for several domestic uses, though its medicinal virtues were unknown. The modern Jews of London use this oil by the name of oil of kiki for their Sabbath lamps, it being one of the five kinds of oil their traditions allow them to burn on such occasions.

In some parts of Europe this shrub is not more than three or four feet high, yet in its native country it is a perennial, fifteen or twenty feet high, with a thick stem. In cold climates it becomes an annual, though there are many other instances of perennial plants becoming annuals by change of climate. The rapid growth of the plant is illustrated by an instance reported in Tennessee. A castor bean was planted in May, in a garden in Memphis, and in November it had grown to the height of twenty-three feet, with a spread of foliage fifteen feet in diameter. The trunk, ten inches above ground, was eighteen inches in circumference. The castor oil plant is extensively cultivated all over India. The plant is cultivated at Lucknow as a mixed crop. It is sown in June by almost all the villagers, principally for their own use for purposes of illumination. There are 67,000 acres under castor oil in the Madras Presidency. The manufacture of castor oil is actively carried on in the United States, especially at St. Louis, the beans being largely produced in Southern Illinois. In 1875, official returns give 24,145 acres under this culture in Kansas, producing 361,386 bushels of seed. In Iowa it has been found a profitable crop, the yield being fifteen to twenty-five bushels of seed per acre.

The ground is prepared, says the Boston *Cultivator*, as for other crops, and the seeds are planted much in the manner of those of Indian corn, with the exception that there is but one seed put into each hill, and that at every fourth row a space is left to admit of the passage of a team for the purpose of gathering the crop. The ripening commences in August. About twenty bushels from an acre of ground is considered a fair yield. The oil is obtained from the seed by expression, by boiling with water, or by the agency of alcohol. Nearly all that is consumed in England is obtained by expression. In this country the seeds, cleansed from the dust and fragments of the capsules, are submitted to a gentle heat, not greater than can be borne by the hand, which is intended to render the oil more fluid, and therefore more easily expressed. The whitish oily liquid thus obtained is boiled with a large quantity of water, and the impurities skimmed off as they rise to the surface. The water dissolves the mucilage and starch, and the albumen is coagulated by the heat, forming a layer between the oil and water. The clear oil is then removed and boiled with a very small quantity of water, the effect of which is to clarify the oil and get rid of the volatile acid matter. Great care is necessary not to carry the heat too far, as the oil would thus acquire a brownish color and acid taste.

In the West Indies the oil is obtained by decoction, but none of it appears in this country. In Calcutta the fruit is shelled by women, the seeds crushed between rollers, then placed in hempen cloths and pressed in the ordinary screw or hydraulic press. The oil thus obtained is afterward heated with water in a tin boiler until the water boils, by which means the mucilage and albumen are separated. The oil is then strained through flannel and put into canisters. Two principal kinds of castor seeds are known, the large and the small, the latter yielding the most oil. The best East Indian castor oil is sold in London as "cold drawn." In some parts of Europe castor oil has been extracted from the seeds by alcohol, but the process is more expensive and yields an inferior article. Castor oil is purified by decantation and filtration, and bleached by exposure to sunlight.

Cat-Tail Down.

M. Bien calls attention, in the *Répertoire de Pharmacie*, to the decided healing properties of an application of the down of the common cat-tail flag *Typha latifolia*) to wounds, particularly to burns and scalds. It is only necessary to puncture the vesicles, to cover them with a dense layer of the down, and to leave this until it drops off. The plant is a common one and well known to everybody; the remedy may therefore be readily tested.

MECHANICAL EXHIBITION AT BOSTON.

One of the good features observable at this exposition of the industrial arts is that nearly all the machines in the machinery department are in motion. This allows the specific work accomplished by each, the *modus operandi*, to be readily ascertained and understood. Among these machines are several that have been already fully described in this journal, as the Buckeye Steam Engine, the Brown Caloric Engine, Worthington's Duplex Engine Pumps, Brainerd's Milling Machines, the Allen Steam Engine Governor, the Chase Steam Engine Governor, etc.; but there are others in operation having improvements that are ingenious and valuable. We refer more particularly to Kidder's Printing Presses, Dooley's Paper Cutter, the Morse Diamond Cutting Machine, Leather Splitting Machine, L. J. Wing's Improved Rotary Engine, Wiswall's Torrent Rotary Pumps, and many woodworking machines.

There is an unusually fine exhibit of steam, water, and gas valves by the Chapman Valve Co., of Boston. The Chapman valves have come prominently before the public during the past five years. They possess features which are of special interest to all persons using valves, and particularly to those who have found difficulty in procuring a valve that would remain tight under the various conditions to which valves are subjected. This company claim to produce a valve that will remain tight permanently when used for hot or cold water, gas or steam, and substantiate their claim by giving a guarantee with every valve. These valves are made with a hollow plug, and have a seat of Babbitt or soft metal instead of hard metal. The seat is cast into dovetail recesses in the body of the valve around the inlet and outlet openings after the plug is placed in position, and forms a perfect seat without grinding. The process of forming the seat is very ingenious, and originated with the manufacturers. These valves are, we are informed, proved at 300 pounds pressure per square inch. In the case of steam valves, with which there is so much trouble, this company guarantee that every valve obtained from them shall remain tight for the space of one year under 150 pounds steam pressure. The workmanship and finish of these valves is very superior. The hydrant by the same company is known as a gate hydrant, and the claim made for the valves extends with equal force to it.

The Boston Blower Co. exhibit a "Lightning Grinder," which was patented November 24, 1874, and improved 1878. This machine is for the purpose of grinding mower and reaper knives. It will grind a uniform bevel from the points to the very base of the sections. It will grind out notches and uneven places. It can be operated by one person. By taking off the knife holder, which is held by two screws, attaching a standard and platform rest, and putting on a larger wheel, the machine becomes an emery wheel grinder, which will sharpen, point or polish plows, cultivator teeth, shovels, mill picks, axes, and all tools used on a farm or in a shop. It is excellent as a cross-cut saw gummer. The emery wheels make 2,000 revolutions per minute. The same company exhibit, on the interchangeable plan, fan blowers, some of which are in operation, for cupola furnaces and forges, puddling and heating furnaces, steam boilers, etc., and also some exhaust fans for removing shavings from wood working machinery and dust from sand and emery wheels. The exhaust fans can also be used for ventilation, refrigerating, etc.

Hill, Clarke & Co., of Boston, have a fine exhibit of machinery, consisting of Flather's Hollow Spindle Engine Lathe, with turret head in place of tail stock and other tools. Their "Concord Buzz Planer" is a very meritorious machine. The shape of the frame is such that any irregularity in the floor will not cause a twist or spring, thereby cramping the tables or throwing them out of line. The tables are both movable and quickly adjusted by the use of one handwheel at each end of the machine; and while being raised or lowered the edge of the table will keep at equal distance from the cutting edge of the cylinder, thus giving the smallest possible amount of opening from the cutters when gauged for work. Their patent adjustable rest or guide is also attached to the machine, and by simply turning one screw it can be set for any bevel, or if desired it can easily be removed from the tables. On the front edge of the back table there is a rabbeting groove by the use of which, in connection with the rest, rabbeting can be done any depth from 1-16th to ½ inch, and any width desired.

A new device which remedies a great railroad nuisance is the noiseless locomotive safety valve invented by Mr. Henry G. Ashton, of the Ashton Valve Company, of Boston. The object of the invention is to overcome the nuisance of the sudden bursting out of steam when a locomotive is moving or standing still. The high pressure of steam in a locomotive boiler finds vent at the inconceivable velocity of 1,600 feet per second through the safety valve. The steam strikes the air with this force, and the problem has been how to avoid a noise proportionate to that force. This noiseless safety valve operates so that no steam is either seen or heard, by simply conducting the escaping steam through a pipe into the tender of the locomotive, where it is used to heat the feed water, which is then pumped warm, instead of cold, into the boiler. Thus all the steam that was blown into the air (with a noise) and wasted is utilized silently, and the public now has, or may have, in respect to a safety valve, a noiseless locomotive.

There is a series of inventions connected with these noiseless safety valves covered by eight patents owned by the Ashton Valve Company, who are applying their valves quite extensively on locomotives of different railroads.

Among the smaller machines at the Exhibition is an ingenious type writer exhibited by Fairbanks, Brown & Co., of New York and Boston. It is intended for use by reporters, editors, authors, copyists, merchants, and professional men. Writing with this machine is done by means of keys, which are compactly arranged in four rows of eleven each, and may be operated by any finger of either hand. On each key is plainly printed the letter or character it represents. By depressing any key, the corresponding letter is printed on the paper. The "action" is fully as rapid and easy as that of the piano. The alphabet, numerals, and all necessary characters for punctuation, italicizing, and reference, are made by it. It is easily adjustable to any desired spacing between lines. The improvements in this little useful machine are numerous, and its construction is different from all other machines of this class. The advantages claimed for it are beautiful legibility, rapidity of action, and ease of operation. The average speed of a pen in ordinary writing is from twelve to twenty-four words per minute. The average speed of the type writer is from forty to seventy-five words per minute, that is, where a single copy only is desired, but as any number of copies from two to twenty can be made at the same time, it follows that with this type writer, and a good operator to use it, from three to twenty hours' work can be done in one hour. Three different kinds of type can be used in the machine.

In the evening the main hall of the building is lighted up in a brilliant manner by the Brush and the Wallace-Farmer electric lights. Of the former there are two No. 5 current machines, each operating four lamps, of 3,000 candle power each, or equal to 200 five-foot gas burners. The machines are operated by a steam engine, and absorb while in action about fourteen horse power. The lamps in use are adapted to burn about thirteen inches of carbon without adjustment, and the carbons last six to seven hours. At the end of this time new carbons may be placed in the lamp in a few seconds without serious interruption of the light. The light produced is a pure white light, like that of the sun. It is very steady, and delicate shades of colors may be detected as well by its use as by sunlight. Another peculiarity of electric light is that it produces very little heat, and gives off an inappreciable amount of non-respirable gases. An equal amount of gaslight produces nearly two hundred times as much heat and about the same proportion of non-respirable gases. The healthfulness of electric light is therefore a great point in its favor, as compared with any other artificial light, and there is no danger of fire or explosion in its use. The steadiness of the light produced by the Brush apparatus is noticeable.

AMERICAN GOODS IN BRAZIL.

In a long and somewhat rambling commentary on the markets of Brazil, a correspondent of the *Evening Post*, writing from Rio de Janeiro, mentions some things worth heeding by those who intend to send goods thither. Following the list of articles forming the cargo of the pioneer steamer, the writer notes that drugs are not likely to gain a large sale. There is a decided preference for French goods, while the experience of the English in supplying the East Indies and other tropical markets gives them a very decided advantage over new rivals. Books will meet with only a limited demand. For rice machinery the prospect is poor, since the cultivation of rice is dying out. Mule shoes are subject to heavy duties, and can scarcely compete successfully. For cut nails there is no market, the French wire nails being preferred, though more costly, owing to their superior penetrating power. Cotton drills should meet with a large sale. So, ultimately, with iron machinery, though it is difficult to compete in cheapness with articles of English and Belgian make. There is, too, a prejudice against American machinery, owing to its lightness and seeming delicacy, which will have to be overcome. Our wood-working machines are often found to be too light for the hard, tough woods of Brazil. American boots should succeed. The market, however, is not so large as the population of the country would suggest, the great mass of laborers, Portuguese, and negroes going barefoot or wearing wooden-soled shoes. We are inclined to think that this custom will not hold out long against cheap and durable shoes of leather. Our printing presses are found to be so superior to those of the French, that they are sure to compete successfully. Small printing offices are numerous, and although they are able to command only small and cheap presses, it is to these rather than to the few large establishments that our press makers and type founders should pay special attention. The market for sewing machines is good, but it will be up-hill work to conquer the prejudice of the people for a long-established American machine of Glasgow make.

American kitchen ware and cutlery are slowly winning favor. In miscellaneous hardware the trade is yet small, owing to the cheapness of European products and the popular prejudice against the lightness of American articles. Hats, if cheap enough, will command a large sale. In the cities the tall, uncomfortable silk hat is almost universally worn. American rifles and pistols are too good for the market. The Brazilian is very little addicted to the use of firearms, and is satisfied with the cheap trash supplied by Belgium. The market for printing paper is not promising, the cheap English and Belgian papers being generally used. Our printer's ink is meeting with ready sale and gives good satisfaction. American type stands high, notwithstanding its greater cost, owing to its toughness and finish. American axes are unexcelled, and are selling in every part of Brazil, in spite of the circumstance that the Germans are flooding the market with an inferior article bearing American makers' trade marks. American clocks sell well. American furniture can be found throughout the greater part of South America. Complaints of its frailty, however, are too frequent. Lard and flour are staple articles, and are sold largely. American butter lacks keeping qualities, and is therefore unsalable.

Some Benefits of the Hard Times.

Commissioner Williamson, of the General Land Office, has prepared a comparative statement of the disposal of public lands during the fiscal years ending June 30, 1877, and June 30, 1878, which shows a general movement Westward during the past year from regions of the East. In nearly all the prominent Eastern cities societies of emigration have been engaged in forming colonies from among mechanics and unemployed laborers with a view of settling them by companies or colonies on the rich lands of the West, and thus relieving the cities of their superfluous and idle population. As Commissioner Williamson says, all this is certainly the good that has come from the evil of hard times. The mechanics, instead of sitting down to groan over the dullness of business prospects, have packed up their families and gone where work will bring an honest return.

Taking Dakota, Kansas, Minnesota and Nebraska, the comparative statement of the disposal of lands during the above periods shows how vastly the emigration has increased. Lands are disposed of by cash purchase, by homestead settlement, for timber culture, and by warrant and scrip location; four different methods, and the records of each are preserved separately in archives of the General Land Office at Washington. For Dakota the figures are:

	1877.	1878.
Cash	20,336·62 acres.	74,940·93 acres.
Homestead	123,869·82 acres.	804,298·66 acres.
Timber culture	68,188·92 acres.	570,224.34 acres.
Warrant and scrip location	5,983.04 acres.	12,346·80 acres.

The table shows an increase of 1,243,423·53 acres in one fiscal year. The same figuring for Kansas shows an increase of 1,356,478·68 acres; for Minnesota, 761,356·10 acres; and for Nebraska, 363,268·98 acres; making a grand total in these four localities alone of 3,724,572·29 acres. Reports show that this business is going on, and that the settlers are doing well. The New York *Tribune* says that the colonies that went to Kansas and Dakota from New York, through the instrumentality of John Kelly, about 4,000 strong, and those that went from Baltimore and Philadelphia, Indianapolis and Boston, are prospering beyond their expectations.

Autumn Suggestions.

Very decided changes in temperature come about at this season, and often without warning. Fresh, cool days are followed by others warm and moist. The *Philadelphia Ledger* tells its readers that it is unhealthy to shiver, and not either pleasant or salutary to sit about while under the sensation of even slight cold. Housekeepers should take care that some apartment in their dwellings is sufficiently warmed by stove or range or furnace to be comfortable. Health, no less than personal satisfaction, is involved in this matter. The slight ailments and occasional serious diseases which mark the change of season arise usually from inattention to the warnings which the body gives in its protests to discomfort. It is said by some to be heroic and hardy to endure the preliminary touches of winter. But it may be that the hero or heroine is simply indolent, and afraid of the labor or care involved by going into winter quarters.

The trees retain their foliage in luxuriant green, and all vegetation is very rank. This late verdure is beautiful, but, like many beautiful things, treacherous. Trees may have malaria lurking about them, more especially when the heat of noon is in wide contrast to the cold of midnight. Nature's chemical processes of the kind that are injurious to the human constitution are accelerated in autumn. As in the laboratory the manipulations of the operator give off gases, so in nature the combinations and changes which are constantly going on affect the wider circle of that grand laboratory, the world which we inhabit. The housekeeper must guard against these influences. The sunlight must be admitted to dwellings—the midnight it is well enough to keep out, except so far as to provide ventilation. Philosophers tell us of the "storing of heat." A simple test and proof of this theory is in the warming of the house by the cheerful sun, and the storing of the heat by preventing its escape as the decline of day weakens the warming rays.

Another seasonable hint is in order, in which the fire brigade and the insurance companies are also interested. The heating apparatus of every building, whether used for dwelling or for business purposes, should be thoroughly examined and put in complete repair. Metal corrodes during the summer, and flues become choked. Hence, from the neglect of precaution, cold weather is ushered in by fire alarms, and the report of casualties ranges from slight up to serious conflagrations. Now is the time for the housekeeper's tour of inspection over the premises (with a glance at the coal-bin, if that is not already filled). All these preparations may be conducted leisurely and comfortably at this time, with no interruption from cold hands. And if mechanics are needed, they will come for the calling, and be glad of the opportunity. A month hence, when the cry is universal, you might as well call "spirits from the vasty deep" as invoke the stove dealer and the plumber.

Curiosities of the American Exporting Trade.

American enterprise in the struggle for supremacy in the world's market has been handicapped by six serious drawbacks. These are, lack of means of transportation, high rates of interest on capital, high rates of marine insurance, carelessness in packing, waste of material in manufacturing, and an omission to make concessions to the local prejudices of outside barbarians.

A good time will probably come when these will all be removed, and then adieu to Communism, pauperism, half-time, over-production, and all the other real or imaginary evils of the day. Kearney will become a bloated bondholder, Schwab will own a brewery and supply beer to the Bavarians, Chinese cheap labor will be welcomed by its whilom opponents turned manufacturers, greenbacks will advance to a premium, gold will be a nuisance, subsidies to steamship lines will be regarded with contempt, and many other equally incredible things from the present point of view will come to pass.

Meantime, Yankee pluck, even with all the odds above mentioned against it, is making a gallant race, and is fast closing upon its antagonists. This is especially true of the past few years—since 1875.

Taking the figures of 1875-6-7 as a basis, we have advanced at the rate of £6,000,000 in two years. Our exports to-day are more than double those of 1860, in which year there was a very heavy export trade, the one article of cotton alone amounting to over $190,000 000, more than twice the cotton export of 1855. In the fiscal year ending June 30, 1878, the increase over 1877 was nearly $65,000 000, or about 11 per cent., and this notwithstanding the greatly lessened demand for war material consequent upon the cessation of hostilities abroad.

The possibilities of the future are enormous. To say that our progress promises to equal that of the past three years is to claim too little. The least we may look for will be an expansion on the compound interest plan.

Our dry goods are superior to those of England, and are preferred wherever they are entered into direct competition with them. Not to put too fine a point upon it, English cotton goods are composed of one part cotton and three parts clay or other filling, while those manufactured here are without make-weight of any kind. American iron is naturally of three or four times the tenacity of English iron, and so on to the end of the list.

In variety or excellence of raw material, no country on the face of the globe can begin to compete with us. European mechanics bear no comparison in skill or intelligence with ours.

An American will turn out four times the quantity of work that a German or an Englishman will in the same time, and he will do it much better. Wages and the price of living have become so reduced on this side of the ocean that in many instances they are lower than in Europe. We have the aid of an unlimited variety of labor-saving machinery, a great deal of which is not known abroad, and nearly all in use there has been imported from this country.

A German gentleman informed the writer that, wishing recently to establish a branch house in his native city, Berlin, he employed the carpenter who has the patronage of the court, and is therefore supposed to be of exceptional skill, to put up for him a wood and glass partition similar to those used in counting-houses in this country. The job occupied six weeks, whereas here six days would have been sufficient. All the mouldings had to be made by hand with clumsy, old-fashioned tools, and the workmen seemed to be mere machines running in a groove, and ambitious only to accomplish as little in a given time as possible.

An American lady in Vienna, in a hurry to catch a train, went into a saddler's shop—trunk stores are unknown there—to order a strap for her trunk. She was told that it could not be made in less than a day. In New York, supposing there were none in stock, a special machine would have turned it out in two minutes. Incidents might be multiplied indefinitely to illustrate this branch of the subject.

Every American who has ever traveled abroad can furnish several from his personal experience. Should proof be needed that all that has been said is true, it may be found in abundance in the columns of the English newspapers. These are filled with complaints of American competition and consequent loss of home trade. One paper—the *British Mail*—tells of a house in Birmingham which is manufacturing "Yankee pattern household sundries, such as egg-whisks, nutmeg-graters, etc.," and placing them on the market as American goods. In another we learn that several extensive padlock makers in the South Staffordshire district are "busy at work upon an order for padlocks upon a favorite United States pattern," and American manufacturers are warned to immediately register their trade-marks in Great Britain under the new treaty. Could any plainer acknowledgment of defeat be given than this?

In all American exports—including breadstuffs—since the foundation of the Republic, three commodities have stood forth prominent in amount and value—cotton, tobacco, and cheese, and of these cotton has been the king. Yet will it be believed that in 1784 an American ship which carried eight bags of cotton into Liverpool was seized on the ground that so much cotton could not be the product of the United States?

In the fiscal year 1860, during which the largest crop was raised and the greatest quantity was exported, 1,767,686,338 pounds were sent abroad, over 1,265,000,000 going to Great Britain.

Tobacco to the amount of 55,000 pounds was exported as early as 1621. Since 1790 we have sent abroad 9,529,123 hogsheads, equal to 13,000,000,000 pounds. To transport this vast product would, it is estimated, require 19,058 ships, carrying 500 hogsheads each, or a yearly average of 216 vessels of that capacity. Will somebody put that in his pipe and smoke it?

Last year, according to the official report of the Commissioner of the Internal Revenue, a greater quantity of manufactured tobacco, and more cigars and cigarettes, were removed directly from the manufactories for exportation than during any previous year of which an account has been kept by the Internal Revenue Office. The excess in tobacco over the year preceding was nearly 3,000,000 pounds. Of the total amount, England takes over 1,000,000 pounds; Australia comes next, Germany next, and the United States of Colombia next. There is scarcely any spot in the civilized world to which we do not export our manufactured tobacco direct.

In Germany the clippings or refuse of the cigars made in this country have recently found a profitable market at from two to five cents per pound. Formerly these clippings were allowed to accumulate in American manufactories for months, until some speculator happened along and took the lot for a song. Now agents have been sent out through Canada to buy up all they can find, with a view to shipping it to Europe.

Immense quantities of American made cigars have, within the past year, been sold in England, where they are eagerly purchased as cheaper and more suited to the popular taste than any cigars heretofore imported into that country. On one day in March last a single shipment was made aggregating 141,000, and it is estimated that the trade already returns at the rate of $4,000,000 per year, equal to an annual profit of $120,000. One firm in this city has even started a factory exclusively for the making of cigars for export to England.

The foreign demand for American cheese exhibits a growth unparalleled by any farm product, except, perhaps, cotton. As recently as forty years ago the exports amounted to but 411,338 pounds. Last year they reached the enormous aggregate of 107,364,666 pounds. If this were loaded on drays, each carrying one ton, and occupying eight yards, the line would extend 244 miles, or a greater distance than from Washington to New York. If the shipment were regular during every secular day in the year the daily movement to the wharves for shipment would exceed 172 tons.

The quantity of milk used in the production of 107,000,000 pounds of cheese may be computed by those having leisure and sufficient agricultural knowledge. Nine-tenths of this vast amount finds a market in Great Britain, which formerly stood pre-eminent in the reputation of her dairy products. Our dairymen have succeeded in imitating the size, general appearance, and even the flavor of the English production so closely, that being able to sell at a much lower price, they have actually beaten the Englishman on his own ground. New York State, by the way, deserves the major portion of the credit for this triumph, over seventy per cent of the cheese manufactured in this country being the product of her factories. In Germany a demand for American cheese has also sprung up, but it has been too recent to permit of the presentation of the results accomplished.

On the subject of breadstuffs there is no need to enlarge here. Every child knows that this country has been for some time the granary of the world. Nor will the ordinary newspaper reader require to be informed that American fresh meat and mutton, both slaughtered and on the hoof, have, within a comparatively short time, to quote an English newspaper, "deprived the English farmer of his last resource, his stalwart ox," and made the national roast beef a common thing in many a British household where it was a rarity before.

Our refrigerator tonnage, which was but 8,000 tons in 1876, is now 28,000 tons. This covers oysters, butter, fruits, eggs, canned goods, and a thousand and one other perishable articles of food, the export trade of which is increasing enormously from year to year. If this thing keeps on it will not be long before America is the butcher's shop and grocery store as well as the granary and manufactory of the world.

What will be thought of the United States shipping plum pudding to England, potatoes to Ireland, oatmeal to Scotland, toys to Nuremberg, and lager beer to Germany? Yet such are the facts, and they are no more astonishing than the now thrice-told tale of the regular and profitable sale of American cotton goods in Manchester, and American cutlery and hardware in Birmingham.

The business of making and canning plum pudding for export is regularly carried on at Dover, Del., and elsewhere. The trade is not a new one, and exports are regularly made to England. A Philadelphia firm sell large quantities of mincemeat in the same country.

Steamer agents say that potatoes to Ireland are the commonest thing in the world, and the business of shipping them has been of long duration.

On April 23 the Devonia took 1,100 bags of oatmeal to Glasgow, from which it must not be inferred that this is by any means an isolated instance, but the first one the writer happened upon in his search for an example.

The export trade in toys, which amounted last year to over $1,000,000, began some five or six years ago through some presents sent abroad. Now nearly every steamer carries large quantities. The principal articles of export are the mechanical or "clock-work" and the steam toys, but there are also large shipments of tin and wooden toys, most of which class were formerly exported from England or Germany. Wood is much cheaper in America than in Europe, and machines work faster than hands.

Very few mechanical toys are now imported, and only the finer French and Austrian work for show-pieces in windows. American ingenuity has also multiplied the varieties of mechanical toys, and the American manufacturers of the clock mechanism have met all overtures for the purchase of the detached works by European dealers by demanding prices which are practically prohibitory.

In May last a firm of German brewers sent a cask of American lager beer to Count Bismarck, and in due time received a letter from him through the German Consul thanking them. Since the reception of the letter the firm have received several orders from German houses for samples of lager beer, and the head of the concern has sailed for Europe to make arrangements for its regular export.

The Englishman has long had American turkeys regularly at Christmas, and he likes them. In January last a famous English house sent an agent to this country with orders to ship regularly every week fifty barrels of the finest quail, prairie hens, grouse, woodcock, wild turkeys, canvas-back ducks, and other American game that he could procure. The enterprise has proved a great success. Buffalo and antelope meat, venison and salmon are also among the innumerable articles of food sent from this country, not only to England, but to nearly every other civilized nation.

It would be unpardonable to close this paragraph, incomplete as it necessarily is, without a mention of the fact that a Boston company are turning out 8,000 cans, equal to 24,000 pounds, of baked beans and codfish-balls daily, and that it finds a large demand for both specialties in England, France, West Indies, and South America.

Room is lacking to pursue the subject to the extent it deserves, but there are numerous other points in the American export trade that must be both novel and curious to the general reader. Take the item of coffins, for instance. Coffins and caskets in the latest styles have long been among the regular articles of shipment abroad, and they command a large sale among the subjects of the effete monarchies. A warehouse containing 2,000 of American make was recently opened in London. Think of exporting hoop-skirts at this late date. Twenty-two dollars' worth went abroad last year.

Berlin has sent a large order for corsets to Worcester, Mass., and another for American silk to Rockville, Conn. Will any one question the good taste of the German ladies after that?

Essex, Mass., exports steel pens to England.

An American firm have made a complete outfit of locks for the new Imperial Post Office in Bremen, where the American system of lock-boxes has been introduced.

Two cargoes of American coal were recently sent to Italy, and were sold readily at $7 72 per ton, which covers cost and freightage and leaves a fair margin of profit. Heretofore, over 200,000 tons of English coke per annum, at $11 58 per ton, has been used in the Mediterranean basin.

A staple article of export to South America and the West Indies is patent water-closets. Another is American confectionery.

Peanut oil, from North Carolina, sells well in Italy, and cotton seed oil has almost taken the place of olive oil throughout Europe. The export of this latter commodity jumped from 281,000 gallons in 1876 to 1,705,000 gallons in 1877.

American jewelry goes everywhere, and American watches have nearly if not quite driven Swiss and English made watches out of their own markets. The British Government purchased 200 stem-winders in December for the use of conductors and engineers on one of the State railroads in India, and in February an agent of the Rotherham Watch Company of England visited this country and ordered a number of sets of the tools and machinery used here.

A Newark, N. J., sash and blind manufacturer filled a large order for shipment o Turkey in June. A Troy bell-founder has recently fitted out churches in Constantinople and Bangkok.

Amer: an locomotive manufacturers are hard at work filling o.ders from Russia and South America. Our carriages, street-cars, and vehicles of all sorts are being sent in all directions. Our petroleum lights the world. Statuary and paintings are regularly exported from this country to Europe. Think of it!

Among other important items of export are books, scientific instruments, wines, pianos, carpets, furniture, toilet soaps, fine and coarse boots and shoes, glassware, scales, stoves, leather, writing inks, slates, marbles, pins, and tools and machinery of all kinds. And the best of it is these things sell on their merits, and not on account of their cheapness. But the list is unending.—*N. Y. Times.*

MARBLE is a limestone that has become crystallized and hardened by heat so as to be capable of receiving a high polish. The action of heat on ordinary limestone is seen wherever such strata have come in close proximity to granite, the heat from which, when in a molten state, having converted the limestone into crystalline marble. The various colors of the marbles are due to the admixture of the oxides of metals, iron giving the red and brown tints, copper the green, and manganese the black.

Notes & Queries

(1) A. F. McA. writes: I send you a scale from a boiler. What will dissolve it? What chemicals is it composed of? I have been using a siphon (steam) for lifting water from my well. Have had great difficulty in keeping my boiler supplied with water since I have been using it. Had none before. Is it because the water is warm in the tank? A. The incrustation consists chiefly of lime carbonate and sulphate, alumina, silica, iron, and organic matter—for the most part readily soluble in hydrochloric acid, which, however, cannot be used in boilers without corroding the iron. The thick portions of the incrustation will have to be removed by mechanical means. It may be somewhat softened by adding a little carbonate of soda to the feed water (about 1 lb. to 40 gallons); but where such addition is made it is necessary to guard against low water and to use the bottom blow out frequently. The proper use of the alkali and the blow out will, in a great measure, prevent the formation of incrustations. If the feed water contains much suspended matter it should be filtered. See p. 107 (31), current volume of the SCIENTIFIC AMERICAN.

(2) J. T. A. asks how the best improved shoemaker's ink is made. A. See pp. 316 (4), vol. 38, and 252 (48), vol. 37, SCIENTIFIC AMERICAN.

(3) Nemo asks for a few hints as to how he can take plaster casts of a human face and hair. A. Place the subject upon his back, with the head raised to the normal position by a pillow of bran or sand, cover the parts intended to be cast with a film of olive or true almond oil, applied with a feather brush or lump of cotton; plug the ears with cotton wool, and insert two quills or pieces of glass tubing in the nostrils and secure the space around them with cotton. When all is ready mix the plaster of Paris with warm water to about the consistence of cream, and with this cover the face from the forehead downward to the lower border of the chin. The eyes should be firmly closed, but in such a manner as not to cause distortion by too violent compression. Then cover the parts of the chest and arms to be represented, carrying the plaster upwards, so as to join the cast of the face. Then (when properly set) carefully remove each, and soak or brush it with linseed oil boiled with a little sugar of lead or litharge. Instead of casting the face and chest in two separate pieces, it is preferable to make the casting in one piece, and to divide it into 4 or 5 sections before removing, by means of threads placed in position before the plaster is applied, and withdrawn when the latter has nearly set. The cast of the back of the head is usually taken by lowering it (well oiled) into a deep trencher partially filled with the liquid plaster, and the back of the neck with the subject face downward. When the mould is finished it is firmly tied together, the joints plugged with a little cotton wool, well oiled on the inside, and a sufficient quantity of tolerably fluid plaster poured in. When the outer portions of the model have nearly set the inner portions are scooped out, and the whole thoroughly dried before removing the mould. The model is trimmed with a sharp knife. If the eyes are not to be represented as closed they must be carved out from the mass.

(4) R. E. A.—See pp. 226 and 395, vol. 37, SCIENTIFIC AMERICAN.

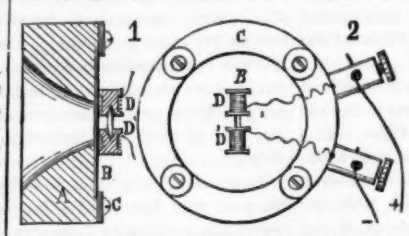
(5) C. C. C. writes: 1. I wish to study chemistry with a view to becoming an analytical chemist and assayer. How long would it take me to complete the course in a university, and is it a good profession? A. The university course (chemical) usually occupies four years; consult the circulars and reports of any of those institutions. The services of ingenious, industrious, and practical chemists are always in demand and command high prices, but many fail in the profession for want of the peculiar natural aptitude or qualifications requisite. 2. Do all large manufacturing establishments have a chemist? A. Not all, but many, in this country.

(6) H. S. C.—You may try the cements mentioned on pp. 171 (3), current volume, and 11 (3), vol. 38, SCIENTIFIC AMERICAN.

(7) E. H. O., Jr., referring to the dynamometer described in No. 9 of the current volume, asks: 1. Will the weight, W, be double the strain on the belt unless the diameter of the gear, D, =½ that of the pulley, A, and the diameter of the gear, E, = that of D? 2. Must the diameter of B bear any ratio to that of either of the others, and if so, what and why? A. The dynamometer measures the power used in driving a machine by the force or weight necessary to hold in place the graduated lever or balance connected with the shaft of the wheel, W, so as to communicate the motion of the pulley, P, to the pulley, B. The diameter of the bevel gears has nothing to do with measuring the power, and may be more or less than that of the pulleys, provided they are equal with each other. If you place a weight of 1 lb. on each end of a lever or scale beam, it is evident that the point of suspension of the scale beam must support the weight of 2 lbs. So the weight on the graduated lever must be equal to the strain of the belt on the rising side of the pulley, P, added to that on the opposite side of the pulley, B, which drives the machine: therefore each belt bears the strain of half the weight indicated by the balance, the pivot of the shaft of the pulleys being the fulcrum of motion of the balance. In other words, the fulcrum of the lever, which is the shaft of the pulleys, bears not only the weight on the graduated lever, but also the weight lifted at the other end.—S. B.

(8) J. W. S. asks: 1. Would a machine, if it could be made to run within itself, be termed perpetual motion? A. Yes. 2. Some people claim that the United States Government offered a reward to any person that could invent perpetual motion. Is this so? A. No.

(9) W. L. S. writes: I have made several forms of microphone, the most effective of which was constructed as follows: Referring to the accompanying engraving: The mouthpiece, A, was turned from walnut, and a ferrotype plate, B, 2¾ inches in diameter, attached, a light ring of blotting paper being placed on



each side at its edge, and the whole secured by screwing over it a flat iron ring, C. Two little cups of gas carbon, D, D', are securely glued upon the disk as near its center as possible. In their cavities rest loosely the ends of a pointed rod of graphite about $\frac{1}{16}$ inch long and $\frac{1}{16}$ or $\frac{1}{12}$ inch thick. It was cut from the core of an ordinary lead pencil. Around the body of each cup is carefully wrapped the exposed end of a piece of insulated copper wire, the other end of which is in connection with its binding screw. Interposing the microphone thus made, and a Bell telephone, in the circuit of one or two Grenet cells, the slightest scratch or rub of a feather was at once audible. The usual experiments with the microphone have been sufficiently described to obviate the necessity of repetition here. Placing the mouthpiece of the present instrument upon my body, a listener with the telephone at the other end of the line, about 200 feet distant, was able distinctly to hear the beating of my heart. The same was still audible, though more faintly, when merely a single finger was placed on the ferrotype plate, and even when the contact was made by means of a short steel rod held between the fingers, while the further end rested as near as convenient to the middle of the disk. This experiment has been successfully repeated with different auditors. Thus far this form of microphone has not yielded satisfactory results when used as a telephone transmitter of articulate speech. Vocal music is taken up by it, but the reproduction is somewhat harsh. Whistling is transmitted less harshly, but not so satisfactorily as when an ordinary telephone is used. Several different sounding boards have been tried, including the one referred to, the sounding box of a tuning fork and that of a sonometer, a stretched membrane, and a mica plate, but I have found the ferrotype disk best.

(10) N. S. writes: I wish to know if I can electroplate steel or iron with Mexican dollars, and what solution is needed? A. It will be necessary to purify the silver. The best solution for silver plating is the double cyanide of silver and potassium, prepared by dissolving the silver oxide or cyanide in excess of potassium cyanide.

(11) F. W. M. writes: Will you please inform me how large an engine it will take to run a lathe with as much power as an ordinary man? How large a boiler, upright, will it take to supply steam for such an engine? How many and what size tubes should you use? A. Make an engine with cylinder 2 x 3. Boiler 10 inches in diameter, 24 inches high, with 28 tubes, ¾ inch diameter and 12 inches long.

(12) C. T. asks how to prepare steel or brass articles for silver plating, so that the silver will not scale off when burnished. A. Immerse for a few minutes in a hot solution of potash or soda, rinse (without touching) in water, dip in dilute nitric acid, remove, and scour with a stiff brush and fine sand if necessary. Then attach the wire, dip again momentarily in the acid, pass quickly through clean water, and immediately place in circuit in the bath.

(13) L. S. I. wishes to know what are the reactions between the hyposulphite of soda ($Na_2S_2O_3$) and sulphate of lime ($CaSO_4+2H_2O$), and what is the resulting compound. A. If the calcium sulphate is neutral there will be no reaction.

(14) W. H. A. asks: 1. What is the motive power of vacuum pumps, and how is it applied? A. Steam is first condensed, thus letting the water into the pump chamber, from which it is then raised by direct steam pressure. 2. Has the pressure of liquids ever been used (as the principal motive power) for raising water from a lower to a higher level? A. There are numerous hydraulic motors utilizing this principle.

(15) A. M. W. asks whether it is necessary to have a microphone at each end of the line, and in what manner to place them in circuit. A. The microphone is simply a transmitter, and should be placed wherever a transmitter is required.

(16) J. A. P. writes: I have a 12 inch magnet and wish to make a battery. Please inform me in regard to the following: 1. What amount and what number of wire do I need on each revolving spool, and what shape should the spools be? A. It depends on the power of your magnet. We think that 2 ozs. of No. 40 wire on each soft iron core would answer. 2. Must the armature be removed or left on? A. When the machine is in use the armature must be removed. 3. Can the spool be attached to the magnet similar to the telephone, and light steel armature made to revolve before the magnet, with success? A. We think not.

(17) J. B. U. asks: How many tons of ice will an ice house hold, 33 feet long, 33 feet wide, and 22 feet high? A. A ton of ice occupies a space of about 35 cubic feet.

Please inform me where I can get a book containing astronomical calculations. I wish to know how astronomers calculate the distance of the sun, moon, and stars from the earth. A. See the official government reports on eclipses and transits.

Where can I get a book containing a full description of the articles exhibited at the Centennial Exhibition? A. There is no one book containing this information.

(18) S. W. D. asks (1) how the magnetism is retained in the telephone magnet. A. Permanent magnets are used. 2. Can it be done so that the north and south poles of a horseshoe magnet can be separately used? A. Telephones are made in which both poles of a horseshoe magnet are used.

(19) W. F. L. writes: Please explain why I cannot get a current through three or more Calland cells when using ground wire that runs into moist ground and put around 10 or 12 feet of iron plates, so as to work a call bell on a common sounder. A. Use a return wire or increase your battery power to 6 or 8 cells.

(20) H. W. B. writes: I am making a hydraulic ram, and I want to know what size to make the air chamber. The outlet to the ram is 1⅜ inch. The pipe that conducts the water to the ram 1¼ inch. Is there any rule to determine the size for different sized rams? A. We do not think there is any definite rule. Make the air chamber as large as convenient.

(21) W. R. H. asks: Is common ground oil or petroleum dangerous to use in steam boilers under steam pressure, object being to remove scale? A. We do not advise its use.

(22) B. H. W. asks for the best method of preserving a steam boiler that is not in use in the summer season from rust. Also the name, price, etc., of the best works on heating and ventilation. A. If you cannot keep the interior perfectly dry, leave the boiler full of water. Schumann's "Manual of H ating and Ventilation," price $1.50, will answer your purpose very well.

(23) H. F. asks: 1. Has the steamer Plymouth Rock of New York got a walking beam? A. Yes. 2. What was her price when new? What are her dimensions and speed? A. Address the owners, Jarrett & Palmer.

Can you give me a good remedy for dyspepsia? A. Plain well cooked food and outdoor exercise.

(24) K. B. A. M. asks for a definition of the mechanical term "spline." A. It is identical with the term "feather," or, as defined by Webster, it is "a rectangular piece fitting the key-seats of a hub and a shaft, so that while the one may slide endwise on the other, both must revolve together."

(25) W. R. L. asks: What preparation can be put on a slip of paper which has lead penciling on it, to keep the marks from being erased? A. A thin wash of gum arabic in water is sometimes used by artists. Skimmed milk will also answer very well.

(26) A. B. asks: What can I put in the plaster of Paris to make it harder? I want to use it to make a phonograph as per SUPPLEMENT No. 133. A. Mix the plaster with strong aqueous alum solution in place of water. The mixture requires a somewhat longer time to set, but ultimately becomes very hard.

(27) E. R. writes: 1. There is a cable wire rope 200 feet long from wheel to wheel, and the two sections make it 400 feet. Running on three wheels, with no bearing between them, and when the rope is slack, it has considerable whipping and jumping all the while. Now if there was a tightener half way between the wheels, would it not prevent this trouble, which wears the rope out very fast by rubbing on the flange of wheel? A. Yes. 2. Would it require more power to run the business with those tighteners on? A. A little more. 3. We have had rubber packing for those wheels, but it being so costly, we have tried wood for packing, but when it rains the rope slips on the packing, thereby causing it to have an unsteady motion. What would be the best and cheapest packing? A. India rubber is the best material, but tarred oakum answers nearly as well and is much cheaper.

(28) G. B. C. asks: Can you tell me how to cement vulcanized India rubber stamps to brass? A. Melt together equal parts of good pitch and gutta percha. Use hot.

How is the purple ink made that is used with "Zuccato's papyrograph?" A. Inks are prepared by dissolving any of the soluble aniline dyes in warm glycerine.

(29) C. O. M. asks: 1. How large a reservoir would it require to run an engine, 2 x 4 inch stroke, 75 revolutions per minute, for 10 hours? The reservoir to be filled with compressed air at pressure of 60 lbs. per square inch. A. Multiply capacity of cylinder per revolution by number of revolutions in 10 hours, and add from 10 to 20 per cent. 2. How much weight should be applied to the top of said reservoir to give a pressure of 60 lbs. per square inch? A. Cross section of reservoir in square inches multiplied by 60, with a slight allowance for friction of piston or plunger.

(30) C. W. O. asks: 1. What gives brass castings the bright gold color which we see on valve bodies? A. The application of a gold colored lacquer. See p. 299 (25), and 44 (39), vol. 38, SCIENTIFIC AMERICAN. 2. Is there a book on brass founding? A. Consult Larkin's "Brass and Iron Founder's Guide" and Overman's "Founder's Pocket Guide."

(31) E. F. D. asks how to make a cement that will adhere to glass and hold water. What I want is a cement for an aquarium. A. A good cement is composed of 3 ozs. of linseed oil, 4 ozs. of tar, and 1 lb. of resin. These are allowed to melt together over a gentle fire. If too much oil is used, the cement will run down the angles of the aquarium; to obviate this, it should be tested before using by allowing a small quan-

tity to cool under cold water, and if not found sufficiently firm, allowing to simmer longer, or have more tar and resin added. The cement should be poured in the angles of the aquarium while in a liquid state, but not when boiling, or it would most assuredly crack the glass. The cement will become firm in a few minutes, and the aquarium may then be tilted up in a different position while a second angle is treated likewise. This composition adheres firmly to the glass, is so pliant that it may be pressed into any shape by the fingers, and it does not communicate any poisonous quality to the water.

(32) J. C. D. asks: 1. Is there any method by which drawings or facsimiles of handwriting can be transmitted by telegraph? A. There are several. 2. And if so, why has it not come into more general use? A. On account of the complication of the apparatus and the time consumed in working it. 3. If there is any method, where could I get a description of it? A. You will find several of them described in Prescott's "Electricity and the Electric Telegraph."

(33) J. K. B. asks: 1. How many revolutions must a fan have, 12 inches in diameter, 4 inch buckets? I wish it to blow the trash out of corn as it enters the millstone to be ground. A. If it is well made, you can run it from 5,000 to 6,000 revolutions a minute. 2. The engine that we are using is badly eaten with tallow; if not tallow I do not know what it is. I supposed it to be the tallow. I have recently fitted up the piston and partly the steam chest, and now I am using West Virginia lubricating oil and beeswax, in proportion 2 of oil to 1 of wax. A. The oil alone will answer very well. We do not think the wax will do any harm.

(34) Engineer asks: 1. Is the curve traced through the points found by the method explained by you in No. 29, "Notes and Queries," of the SCIENTIFIC AMERICAN for August 17, adiabatic, or only hyperbolic, having a slightly larger valuation than the one formed from the equation $x\,a' = b\,a$? A. The curve is an approximated one for dry saturated steam. 2. Will you please construct a formula or equation, and give an example, from the symbols $P \propto n^{-\frac{10}{9}}$, as given in Rankine's "Manual of the Steam Engine," p. 385, article 282? A. a=piston stroke (clearance added) to point of release. a'=piston stroke (clearance added) to any other point. P=initial pressure of steam. P'=pressure at point a'. $P' = P \times \left(\frac{a'}{a}\right)^{\frac{10}{9}}$. *Example*: a=60. a'=30. P=100. $\frac{a'}{a} = 0{\cdot}5$.

Log. 0·5 — 1·6989700
Multiply by 10

Log. of 10th power of 0·5 4·9897000
Divide by 9) 4·9897000

Log. of $\frac{10}{9}$th power of 0·5 — 1·6655222
Add log. of 100 — 2·

Log. of pressure at a' — 1·6655222
Corresponding number, pressure at a', 46·3.

(35) R. C. K.—See p. 139 (11), current volume.

(36) C. K. asks: 1. In vertical engines, how much weight should be counterbalanced, the pitman, piston rod and head, or the pitman and crank? A. Connecting rod, piston rod, crosshead, piston, and crank. 2. Which is the best way to screw crank pins into the crank, by riveting or by nuts? A. Nuts, generally. 3. Can a correct judgment be given as to the merits of an engine by the working of a small one, say a ½ inch bore and 3 inch stroke, double cylinder? A. Many points can be determined in this way, but not all.

(37) J. L. K. writes: Please give me the lifting power of a cask, 100 gallons capacity, attached to a dead weight and pumped full of air, at a depth of 10 or 12 fathoms. A. It will be equal to the difference between the weight of water displaced, and the weight of the cask and its contents. For power of windmills see vol. 32, p. 241.

(38) B. S. & M. ask: Do the driving wheels of a locomotive slip in passing an ordinary curve? I contend that they do not, as the face of the wheels on steam roads is beveled. In curving the inside wheel comes to the small or narrow part of the face, the outside wheel must ride on the high or large part. A. If the curving is right for one curve, it may not suit another having a different radius, so that there may be cases where a slip will occur.

(39) J. M.—We do not know that there is any advantage in placing water at the bottom of the ash pit.

(40) C. O. H. asks: What is the best blacking for dressing up a steam boiler and smoke stack? A. A black varnish made from mineral oil answers very well.

(41) S. P.—It is impossible to make a cheap heliostat with one mirror which will keep a beam of sunlight fixed in any given horizontal direction. The double mirror heliostat, described by Mayer in his work on light, may, however, be cheaply converted into an automatically movable one, by connecting a pulley on its polar axis with another of half the circumference on the hour axle of a common spring clock by means of a band. The theory of the single mirror heliostat in its numerous forms must be sought in special works, *e. g.*, Jamin's "Cours de Physique de l'Ecole Polytechnique."

(42) G. C. L. writes: 1. I want to make a telephone, and hear that I can purchase in New York all the necessary parts ready to put together. A. Full directions for making a telephone are contained in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 142. 2. Do I render myself liable to patent suits? A. See "Rights of Investigators," p. 128, current volume of SCIENTIFIC AMERICAN.

(43) E. G. B. writes: Suppose that we have a line shaft running about 180 or 200 feet, the power at one end and a fan at the other. Now if we would move the fan up close to the power, still leaving the line shaft in its original place, would it require any more power at one place than it would at the other? A. We think there would be no essential difference if the shaft is of sufficient size and well supported.

(44) E. R. D. writes: I have been troubled the same as T. T. writes in your issue of September 21, 1878, and, after trying all the experiments that he relates, have found that the only material that will withstand the action of steam, oil or tallow is pure asbestos. A. This is often good, but we scarcely think that it is the only material.

(45) G. G. L. writes: I propose going from New York to Florida in a staunch 25 foot steam yacht, and I wish to ask if you think it is safe, or if it is a dangerous undertaking. What would I need besides coast charts and compass to aid me? A. It would not be very dangerous with a good boat. You should have lanterns, a sounding line, two good anchors, and some life preservers, in addition to the articles you have named.

(46) M. S.—Weissenborn's "American Engineering" contains full details of beam engines.

(47) I. T. S. asks: What is the composition of a good flux for purifying metals, such as brass, pewter, hard lead, etc.? My object, for instance, is to separate in brass turnings the iron filings. A. The metals cannot be separated by fluxes alone. The brass and iron filings or turnings may be most economically separated by means of good electro-magnets, arranged on the periphery of a wheel or in any other suitable manner.

(48) F. K. asks: 1. Is a Smee battery with center plate of carbon a good battery for silver plating? A. Yes. 2. If so, what surface of zinc and anode is required to a given surface of work? A. Your anode may have twice the surface of the zinc. 3. What is the standard used by platers for 4, 8, and 12 oz. plate, or, in other words, how many table or tea spoons is 4 ozs. of silver put on for a single plate? A. For a 4 oz. plate 4 ozs. of silver are put on a gross of spoons. 4. Is it any more necessary that different cells of a battery should be charged alike for quantity than for intensity? A. No.

(49) O. H. asks: Could you inform me of the existence of any substance which will make metal adhere to wood? A. Melt together equal parts of clear pitch and gutta percha. Apply hot.

(50) G. W. K. asks: What is the best English publication on numismatics? A. Consult Prime's "Coins, Medals, and Seals," Dickinson's "American Numismatic Manual," Faure's "Catalogue de Medailles antiques et Monnaies du Moyen Age composant sa Cabinet."

(51) F. W.—The star Mira Ceti will be found on the horizon at about 5° south of east.

(52) W. R. S.—To secure an artificial mustache you may try the cements recommended on p. 171 (3), current volume, SCIENTIFIC AMERICAN. Also p. 11 (3), vol. 38. These "masks" are, we believe, usually held in position by small springs entering the nostrils.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. S. R.—A fragment of quartz.—J. S. R.—Please send larger sample of the ore.—T. S. B.—No. 1. The sample of earth does not contain phosphates. No. 2 is dolomite or magnesian limestone. It may be used for building purposes.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

On the Steam Ram. By S. S.
A Climax to Mechanical Invention. By E. L. T.
Egyptian Lotus. By J. S.
Elephantiasis vs. Leprosy. By T. C.
How to make a Simple Beam Compass. By M. A. B.
Mechanical Stoker. By D. S.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 13, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Advertising card, O. J. Ramsdell	206,969
Advertiser, illuminated, G. H. Chatterton	206,861
Alkali balls, composition for coating, A. Mendleson	206,891
Amalgamator and washer, ore, Firmin & Forster	207,093
Apple corer and slicer, Pfeifer & Ulrich	206,967
Bag holder, W. B. Allen	206,915
Baking powder, W. P. Clotworthy	206,980
Bale tie, A. Roeber	207,071
Basket, flower, F. C. Tennyson	207,083
Bed, camp, F. J. De Morambert	207,060
Bed, sofa, S. Squires	206,980
Bedstead, table, E. Kiss (r)	8,375
Belt fastener, A. J. Johnson	207,038
Bird cages, fastener for, C. M. Neubauer	207,063
Bird cages, food holder for, B. A. Drayton	206,867
Blasting wedge, O. F. Brockhausen	206,927
Blind stop, A. F. Fuller	207,036
Blind, window, J. E. Goodrich	207,037
Blotter, tablet, C. M. Cott	207,017
Boats, outrigger, etc. for, Roberts & Knight	207,070
Bolt threading machine, T. Thomas	207,084
Boot and shoe, A. Van Wagenen	206,985
Bottle and bottle stopper, H. Codd (r)	8,372
Bottles, pliers for wiring, B. P. Kincaid	206,951
Bung, W. Bender	206,923
Button, F. A. Comey	206,931
Can and vent for oil, jacketed, J. S. Lester	207,046
Can lids, locking device for, W. E. Jenkins	206,879
Can, sheet metal, G. D. Brooks	207,007
Can, sheet metal, Miller & Coll	207,058
Canvas, making artists', W. Levin	206,885
Canvas, painters', W. Levin	206,886
Car coupling, J. Ballard	207,094
Car coupling, A. Rice	207,068
Carpet sweeper, F. Kammerer	207,040
Carriages, hanging, C. Schmitt	207,075
Cattle and sheep, marker for, T. Madden	206,889
Chair, window cleaning step, A. Dormitzer. 206,935,	206,936
Chandelier, extension, H. Tucker (r)	8,371
Chimney or ventilator cup or cowl, D. Scott	206,978
Churn, T. A. Irick	207,037
Churn, Tise & Kester	207,085
Cigar tip protector, C. R. Becker	206,921
Clamp, H. W. Atwater	206,851
Clamp for holding bolts, J. W. Leete	206,954
Clasp for supporting garments, S. Porter	206,896
Cloth shearer, rest for, A. Woolson. 207,090, 207,091,	207,092
Cock, steam, J. Dowling	206,937
Coffee, etc., cleaner and polisher, M. Doyle	206,866
Coffee roaster, J. B. & W. H. Wiggerman	206,911
Collar, M. Hermann	207,034
Collar, J. K. P. Pine (r)	8,369
Colors on glass, etc., producing, F. S. Shirley	207,077
Cooler, beer, W. B. Frantz	206,941
Cooler, milk, S. R. Bryant	207,008
Corn marker, D. S. Harner	207,031
Corset, C. L. Olmstead	206,964
Corset, J. K. Ross	206,900
Corset, H. S. Strauss	206,906
Cotton scraper and chopper, Gibson & McDaniel	206,871
Crocheting fabrics, machine for, H. A. House	206,878
Cultivator, C. D. Bradley	206,925
Cultivator, C. E. Sackett	206,974
Cultivator, S. R. Stanton	206,903
Cultivator wheel, J. E. Mustard	206,961
Cut-off valve for steam engines, R. Sanderson	206,975
Dental purposes, abrading tool for, E. T. Starr	207,079
Door alarm, F. C. Renner	206,899
Door securer, W. D. Rumsey	207,073
Drill hoe, grain, A. Landis	206,884
Drilling metal, A. J. Smart	206,979
End gate for wagons, W. H. Parkin	206,966
Engine, portable steam, W. H. Tappey	207,082
Evaporator, liquid, J. J. Johnston (r)	8,373
Evaporating liquids, process for, J. J. Johnston (r)	8,374
Excavator, C. Pontes	207,064
Fan, automatic, W. Duchemin	207,022
Fence, J. D. & W. E. Mandeville	207,050
Fence, E. D. Youngs	206,993
Fertilizer and grain distributer, S. S. Morton	207,062
Fertilizer distributer, B. Kuhns	207,043
Filter, water, P. P. Emory	206,938
Firearm, breech-loading, F. J. Mesle	207,056
Firearms, lock for, J. M. Wittman	206,991
Fire escape, C. H. Ames	206,916
Fire extinguisher, H. S. Parmelee (r)	8,376
Foot power, W. F. Lane	206,952
Fork, M. Naumier	206,894
Forks, ferrule for spading, W. H. Buckley	207,009
Fruit drier, A. C. Burdick	206,860
Funnel, measuring, D. Hitchcock	206,946
Furnace, ore roasting, etc., A. Ramage	207,065
Garbage holder, R. Cook	207,016
Gas light extinguisher, Brand & King	206,926
Gas, preparing nitrogen, G. A. Treutler	207,086
Gas regulator for retorts, L. G. McCauley	207,052
Gate, Hastings & Cock	207,032
Gate, farm, H. W. Goodwin	206,942
Gate, farm, S. Schreffler, Jr.	207,078
Glove fastening, A. B. Kittson	206,888
Grain separator, R. Clarke	206,929
Grain separator, M. P. Korsgaard	207,042
Grain separator, A. M. Sutherland	206,982
Grate holder, Howdon & Wood	207,036
Gun, machine, F. L. Bailey	206,852
Harrow, S. Beckner	206,922
Harrow, J. Johnson	207,039
Harrow and seeder, wheel, J. S. Foster	207,025
Harvester, T. S. Brown	206,857
Hay carrier, E. A. Walters	206,987
Hay tedder, E. W. Bullard	207,010
Hay tedder, W. M. Saunders	207,074
Hedges, constructing osage-orange, J. Kline	207,041
Hides, unhairer, scourer, etc. for, J. A. Talpey	207,081
Hinge for folding seats, R. T. Hambrook	206,875
Hinge, lock, H. M. Ralston	206,897
Hog cholera compound, J. P. Cole	206,863
Hoister, tobacco, J. M. Wadlington	206,986
Hoisting apparatus, tobacco, W. A. & W. S. Guy	207,030
Holdback for vehicles, E. E. Morse	207,061
Honey comb, foundation for, M. Metcalf	207,057
Hops, sack for baling, C. A. Sands	206,976
Horse nail machine, J. Mills	207,059
Horse power, C. E. Macarthy (r)	8,366
Horse power equalizer, L. B. Rowland	206,973
Horseshoe, D. F. Fetter	206,939
Horseshoe nail machine, J. D. Sumner	206,907
Horseshoes, die for making, G. Bryden	206,859
Horseshoes, manufacture of, G. Bryden	206,858
Hot air register and evaporator, W. L. McDowell	206,890
Hydrant for watering stock, J. Compton	207,015
Insect destroyer, J. P. Ruhmann	206,901
Ironing table, W. C. McGill	207,054
Knife scales, manufacture of, W. Baker	206,919
Knitting machine cylinder, A. Greiss	207,029
Lamp, Stephens & Lameraux	206,904
Lamp and stove, R. R. Moore	206,900
Lamp burner, W. O. Lincoln	207,048
Lamp, carbureting, C. E. Ball	206,909
Land leveler, S. Griffin	206,943
Lantern, L. J. Atwood . 206,917,	206,918
Lantern, C. H. Viereck	207,088
Lantern, signal, S. Coxon	206,933
Lock, time, J. L. Hall	206,872
Lock, time, S. M. Lillie	206,887
Lock, time, E. Stewart	206,981
Lubricator, C. F. Raymond	207,067
Lumber trimming machine, G. W. Nichols	206,962
Meal, flour, etc., drying, J. T. Maybury	207,051
Medicament, coated compressed, C. Carter	207,013
Middlings separator, W. H. Fruen	206,869
Mill attachment, grinding, C. V. Stevens	206,905
Mill, cider, J. L. Barnes	207,001
Mill, grinding, M. B. Atkinson	206,996
Millstone dress, W. D. Odendahl	206,963
Millstone dressing machine, W. Coplin (r)	8,377
Millstone driver, P. H. Childress	207,014
Mower, lawn, A. H. Rau	207,066
Numbering machine, T. S. Bowman	206,924
Nut lock, W. J. Brassington	207,006
Nut lock, J. C. Lewis	207,047
Odorless closet, W. Glover	206,874
Oil, transporting petroleum, R. A. Wilder	206,990
Oiler for locomotives, O. A. Haynes	207,033
Paper pulp, separating, P. & G. C. Rose	206,971
Paper pulp washer, H. Hollingsworth	206,877
Pen holder, T. B. Jeffery	206,950
Photographs, coloring, Price & Klingaman	206,968
Pins, making wooden, A. M. Kendall	206,882
Pitcher, S. W. Babbitt	206,997
Planter, corn, Goodwin & Hurlburt	207,028
Plow, F. Johnson	206,880
Plow, C. P. McWane	206,958
Plow point, White & Francis	206,910
Plow, sulky, J. C. Welsh	206,989
Pocket books, etc., clasp for, Wolf & Loeb	207,089
Potatoes, removing the skin of, A. R. Davis	206,934
Press, baling, P. K. Dederick	206,865
Press, hop, C. A. Sands	206,977
Printing press, Rosser & Briggs	206,972
Propelling vessels, Cowles & Brewer	207,018
Pump, C. F. & S. Rigby, 3d	206,970
Pump bucket, chain, M. C. Bignall	206,854
Pump bucket chain, J. S. Wilcox (r)	8,370
Pump chains, making, J. Adt	206,995
Pump, oil well, M. Lytle . 206,888,	206,956
Punkas, apparatus for working, Parsons & Palliser	206,895
Quilting frame, W. E. Barker	207,000
Railway spike, E. J. Remillon	206,898
Railway switch, street, J. V. McIlroy	206,957
Railway track, A. Herring	206,876
Rake, horse hay, T. S. Miller	206,959
Rein for two horses, driving, G. R. Woolsey	206,912
Rein holder, R. Floryanowicz	207,024
Rice hulling machine, W. G. Stevenson	207,080
Riveting machine, H. Mac Coll	207,049
Roofing, etc., material for, D. S. Armstrong	206,850
Ruling paper, machine for, E. Gouptel	206,873
Sash and frame skylight, J. L. Cox	207,019
Sash fastener, Fogelstrand & Sparks	206,940
Saw handle, crosscut, M. E. True	206,908
Saw tooth, insertible, J. L. Berry	207,003
Screw cutting stock and tool, E. P. Baville	206,920
Sewing machine, T. Lamb	207,044
Sewing machine, Young & Dimond	206,993
Sewing machine, blind stitch, Hoffman & Meyers	207,035
Sewing machine shuttle, E. Bouscay	207,004
Shawl strap, W. T. Butler	206,928
Shirt, G. A. McFadden	207,053
Shirt neck shaper, A. Borchardt	206,856
Shoulder brace, A. Adamson	206,994
Skylight, A. & G. Bickelhoupt	206,853
Spike extractor, J. F. Scribner	206,902
Spinning ring, J. W. Wattles	206,988
Spring, vehicle, W. Chegwin	206,862
Springs, clip for vehicle, J. Bowden	207,005
Springs, retarding recoil of, Dick & Luders	207,020
Springs, retarding recoil of, C. J. A. Dick	207,021
Stamp, branding, W. L. Gamage	206,870
Steam generator, J. G. Baker	206,998
Steamer, feed, Craine & Gaylord	206,864
Stomach and enema pump, E. Rosenzi	207,072
Stove attachment, Lawrence and Strawbridge	206,953
Stove polish, H. J. Dreher	206,868
Stoves, fender for cooking, B. S. Hite	206,947
Swimming, apparatus for teaching, T. H. Monstery	206,892
Table slide, extension, H. W. McIntyre	207,055
Tar, package for, C. H. Leggett	207,045
Target, ball, C. A. Tatum	206,989
Telephone resonator, C. E. Carmon	207,011
Thill coupling, Holdredge & Cowan	206,948
Thill coupling, W. S. Palmer	206,965
Thrashing machine teeth, Richardson & Morgan	207,069
Toy bank, E. R. Morrison	206,893
Treadle, A. L. Akins	206,914
Truck and bag holder, Bissell & Van Buren	206,855
Turbine wheel, etc., U. S. & W. H. Sheffer	207,076
Twine holder, J. W. Turner	206,984
Type writing machine, E. R. Barron	207,002
Ultramarine, manufacture of red, J. Zeltner	207,093
Valve, globe, J. Powell (r) . 8,367,	8,368
Ventilator for blow and dust rooms, J. B. Holmes	206,949
Wagon hound, J. Q. Adams	206,913
Wagon jack, H. Hiestand, Jr.	206,914
Wash board, B. Kaufmann	206,881
Wells, casing head for oil, F. A. Conkle	206,932
Wheel, vehicle, C. S. Carpenter	207,012
Wheelbarrow, J. Lennon	206,955
Whip socket, F. Higgins	206,945
Whitewashing machine, J. P. Weber	206,909
Wrench, axle nut, A. Van Wie	207,087

TRADE MARKS.

Baking powder, C. E. Andrews & Co	6,461
Boot and shoe blacking, Boyer & Co	6,473
Brushes, J. L. Whiting . 6,469,	6,470
Condiments, such as pickles, etc., F. & J. Heinz	6,464
Cooking stoves, S. S. Jewett & Co	6,475
Dry goods, C. M. Williams	6,460
Dry hop yeast, Judd Brothers Yeast Company	6,465
Fancy furs, etc., J. E. Bergtold	6,478
Flour, H. F. Harrington	6,454
Flour, Kenly, Jenkins & Young	6,455
Fruit preserving substances, L. P. Worrall	6,459
Medicines, B. F. Rackley	6,467
Medicine for horses, etc., J. Saunders	6,480
Photographic material, E. & H. T. Anthony & Co.	6,472
Prints, Eddystone Manuf. Company . 6,457,	6,458
Printing plates, L. Brown & Co	6,458
Salt, R. Evans	6,479
Salve, Schloss & Frech	6,456
Sewing and knitting needles, H. Baylis	6,474
Smoking and chewing tobacco, Maclin & Barkley	6,477
Soap, C. F. Bates	6,462
Soap, Day & Frick	6,463
Thrashing machine, Seymour, Sabin & Co	6,481
Water closets, Zane & Roach	6,471
Wines and brandies, Renauld, Francois & Co	6,468
Wood heating stoves, S. S. Jewett & Co . 6,466,	6,476

DESIGNS.

Burial caskets, A. H. Nirdlinger	10,776
Carpet, H. Christie	10,778
Carpet, C. Magee . 10,779,	10,780
Carpet, J. Neil	10,781
Font of types, D. W. Bruce	10,777
Rocking chairs, S. Willershausen	10,782

[For the week ending August 6th.]

TRADE MARKS.

Baking powder, G. W. Kendall	6,450
Cassimeres, F. Glasier	6,437
Churns, Tiffin Union Churn Company	6,451
Cigars, H. Welsh	6,445
Coffees and spices, J. Prusso	6,439
Fertilizers, H. Duvall & Co	6,434
Flour, G. V. Hecker	6,438

Flour, Red Wing Mills 6,441, 6,442
Heating and cooking stoves, Detroit Stove Works. 6,435
Lard, F. G. Pierra 6,440
Medicinal preparations, T. H. Videto 6,443
Medicinal preparation, J. L. Wallach 6,444
Plug tobacco, H. Welsh 6,446, 6,447, 6,448, 6,449
Spool cotton, A. D. Warren 6,432
Tickings, Eagle and Phenix Manufacturing Co. 6,436

DESIGNS.

Chairs, Harwood & Wood 10,766
Crackers, Fowler & Rockwell 10,765
Fonts of type, J. Herriet .... 10,767 to 10,769
Hand wheel for globe valves, J. L. Wolcott 10,775
Oil cloths, C. T. & V. E. Meyer .... 10,770 to 10,772
Overshoes, G. Watkinson 10,774
Pocket lamp, C. S. Tallmadge 10,773
Sewing machine bracket arm, G. S. Darling 10,764

FOR THE WEEK ENDING AUGUST 20TH.

Adding machine, M. W. Clay 207,255
Axle, vehicle, W. Beers (r) 8,384
Axles, upsetting collars on, J. C. Richardson 207,208
Bale tie, J. C. Harper 207,278
Bale tie, wire, R. H. Bartlett 207,097
Balls, manufacturing seamless, J. Brant 207,158
Barrel cover, S. W. Sheldon 207,214
Basins, overflow and trap for, C. H. Moore 207,197
Bath apparatus, vapor, G. W. Carpender 207,249
Battery, galvanic, W. W. Griscom 207,270
Belt stretcher, C. K. Dodge 207,259
Blackboard, E. G. Durant 207,111
Bleaching, etc., fabrics in bulk, L. W. Wright 207,334
Blind wiring machine, C. Hinz 207,181
Boiler feeder, automatic, F. A. Wells 207,326
Boiler, steam, Salisbury & Smith 207,133
Boilers, heater for steam, H. Park 207,298
Bolt clipping machine, Chambers Jr. & Mendham 207,252
Boot and shoe, A. Van Wagenen 207,227
Boot and shoe counters, skiver for, S. D. Tripp 207,223
Boot jack, J. Roberts 207,209
Bottle corking machine, J. C. M. Braun 207,244
Bottle stopper, E. Harris (r) 8,382
Bottle stopper and sprinkler, T. J. Holmes 207,279
Bottle washer, P. Seibel, Jr 207,311
Box, berry, Morey & McDonald 207,199
Braid, etc. in packages, holder for, S. B. Fleisher 207,114
Brake, car, S. Hewitt 207,179
Brake for cars, air, J. M. Maxwell 207,126
Brake, elevator, R. Marshall 207,291
Brake, wagon, W. G. Fink 207,171
Brick making machinery, W. Mendham 207,293
Brush, S. Crane 207,256
Brush, T. Dillon 207,110
Calipers, A. Schmitter 207,308
Can, J. W. Masury 207,191
Can or package for paints, J. W. Masury 207,190
Cans, securing caps or covers to, D. Parks 207,131
Car coupling, J. L. Berry 207,100
Car journal cooler, R. C. Morris 207,336
Car platform, Janney & Mathews 207,183
Car roof, J. L. Burnham (r) 8,383
Carding machine, B. F. Haigh 207,272
Carriage, child's, Sues & Raplee 207,220
Carriages, heating railway, Lemeunier & Gerard. 207,289
Cartridge for firearms, Bush & Krauspe 207,248
Carving machine, M. Rice 207,307
Casting ingot moulds, core for, E. J. Kelly 207,285
Cellar, waterproof, T. New (r) 8,387
Chair, barber's, E. Berninghaus 207,099
Chair, dentist's, White & Ashmead (r) 8,380
Chair, folding rocking, H. B. Smith 207,312
Chair, nursery, C. A. Perley 207,305
Chair, rocking, W. Seng 207,135
Chairs, head rest for dental, E. T. Starr 207,316
China, etc., riveting broken, P. Forrester 207,265
Churn, H. F. Hogan 207,276
Churning apparatus, S. S. Zahm 207,233
Clamp, miter, F. P. Moser 207,295
Cloth drying machine, J. S. Winsor 207,329
Clothes line holder, J. W. Turner 207,224
Clothes rack, S. Reed 207,132
Cock casing, stop, P. Burke 207,246
Coin holder, H. G. Pearson 207,300
Compasses, blackboard, C. W. Blake 207,101
Cooler, beer, W. F. Fey 207,264
Corn sheller, C. C. Burroughs 207,163
Corset clasp, L. M. Chipley 207,253
Crane, hydraulic, C. H. Morgan 207,200
Cross tie, iron, J. A. Bonnell 207,242
Damping roller, J. A. Brown 207,160
Dental rubber dam clamp, C. E. Bucey 207,103
Derrick, portable, McCord, Jr. & Alexander 207,292
Ditching machine, B. F. Sherrick 207,137
Drill chuck, Elterich & Briggs 207,113
Drill for boring blast holes, expanding, J. Julien. 207,122
Drill, upright metal, O. Plummer 207,306
Drilling machine, rock, S. G. Bryer 207,162
Elevator, grain, J. E. Walsh 207,323
Embroidery pattern, R. T. Smith 207,141
End gate, wagon, D. Austin 207,095
Engine, fire, D. M. Cooper 207,165
Engines, portable steam, W. Baxter 207,237
Epithem, B. A. Prophet 207,302
Eyeglass, P. E. Godefroy 207,116
Fabric stretcher, dipper, and drier, J. D. McLean. 207,192
Feather renovator, Gibbons & Ashmore 207,266
Fence post and fence, Clark & Lothrop 207,254
Fifth wheel, L. G. Share 207,213
Fire alarms, thermostat for, G. S. Shute 207,139
Firearm, revolving, H. M. Erskine 207,168
Fish eggs, hatcher for, I. H. Wright 207,333
Flour dressing machine, T. F. Greenleaf 207,176
Founder's facings, A. Wainwright 207,321
Furnace, metallurgic gas, C. Grobe 207,177
Furnace, metallurgic gas, W. Swindell 207,221
Gas regulator, G. S. Lacey 207,187
Gas scrubber, Smith & Farmer 207,216
Gate, W. B. Allen 207,149
Gate, J. Hill 207,274
Gate, J. Medhurst 207,129
Gate and door fastening, E. S. Hunt 207,120
Glassware, preparing articles of, G. W. Blair 207,241
Grain binder, M. A. Keller 207,123
Grain scourer, G. Moench 207,294
Grain scouring machine, C. Schaschue 207,307
Grain separator, H. A. Barnard 207,236
Grain separator, A. B. Farquhar 207,170
Graves, coping and covering for, C. H. Bassett 207,156
Harvester, C. McGregory 207,128
Harvester cutting apparatus, T. H. Eulass 207,169
Hay rack, C. Stevenson 207,219
Head lights, signal for locomotive, W. Kelley 207,284
Hoes, manufacture of, J. Bergmann 207,288
Horse collar, H. L. Mennerich 207,194
Horse detacher, C. J. Walser 207,143
Horse power, J. H. Blain 207,155
Household utensil, E. Brown 207,161
Hub, carriage wheel, W. Reinhard 207,308
Hub, vehicle, Rouse & Stoddard 207,210
Hydrant, F. Jarecki 207,185
Ice, apparatus for making, D. L. Holden 207,278
Ice, apparatus for making, E. P. Lorch 207,290
Ice tongs, C. P. Payson 207,204
Indicator, J. Tatham 207,219
Indicator, low water, J. L. Walker 207,322
Insect destroyer, P. S. Ryan 207,306
Insecticide, J. Barth, Jr 207,235
Lamp, C. F. Spencer 207,314
Lamp chimney, S. B. Inglis 207,280
Lamp lighting device, F. G. Stephenson 207,317
Lamp, street, F. H. Shepherd 207,136
Lantern, E. F. Cash 207,104
Lathes, scroll saw attachment to, T. R. Almond 207,150
Life boat, F. Dunn 207,166
Liquid measures, drip pan for, E. M. Shirley 207,138
Lock, W. H. Taylor (r) 8,379
Lock for packing boxes, seal, B. S. Atwood 207,234
Lubricator, vehicle axle, R. R. Moore 207,195
Mash rake, C. Kaestner 207,283
Meat tenderer, J. P. Davies 207,107
Meats, apparatus for curing, D. L. Holden 207,277
Meats, apparatus for preserving, W. I. Goodin 207,268
Middlings purifier, A. R. Guilder (r) 8,386
Mill, hominy, Engelke, Feiner & Weismantel 207,261
Mining rifle, C. O. Bagley 207,153
Motor, King & White 207,186
Motor, water, A. W. Bush 207,247
Myopia, device for preventing, D. Morse 207,198
Nail and spike extractor, W. H. Barwick 207,098
Nails under water, driving, W. Stack 207,315
Neck tie, R. Waterhouse 207,324
Neck tie folder, W. A. Laverty 207,288
Nut lock, J. S. Hoffecker 207,275
Nut tapping machine, J. S. Winsor 207,331
Oatmeal machine, G. Ayliffe 207,152
Oil, transporting petroleum, R. A. Wilder 207,231
Padlock, H. Schroder 207,310
Paint, M. B. Bailey 207,096
Paper card baskets, making, R. W. Betts 207,239
Paper cutting machine, W. T. Shaffer 207,212
Paper fasteners, attaching, C. W. Blake 207,157
Paper making machines, roller for, F. A. B. Koons 207,287
Pen, fountain, W. W. Stewart 207,318
Pier, E. Wasell 207,228
Plaiting machine, M. A. Maybee 207,127
Planter and check row marker, W. M. Carriker 207,250
Planter, corn, Chambers & Boring 207,251
Planter, corn, Wright & McNary 207,148
Plow, J. O. Farrell 207,130
Plow, L. Gibbs 207,174
Pole and shafts, wagon, F. Rice 207,304
Potato digger, Green & Howland 207,175
Press glass, G. W. Weyman 207,327
Pump, steam, Van Tassel & Paup 207,226
Puzzle block, E. U. Kinsey 207,124
Railway cross tie, J. H. Thompson 207,320
Railway frog, W. Wharton, Jr 207,328
Railway gate, S. Barnes 207,154
Railway, portable, F. Amat 207,151
Railway rail joint, D. R. Harder 207,119
Railway rail joint, S. E. Hilliard 207,180
Railways, etc., support for elevated, B. F. Britton 207,245
Railways, griper for wire rope, J. Hansen 207,118
Rake, horse hay, J. J. Squire 207,217
Root cutter, W. F. Weller 207,144
Sad iron, C. H. Parsons 207,299
Saddle, harness, J. Patten 207,203
Sash, window, A. Rudolph 207,305
Saw, hand, W. Berney 207,159
Saw mill appliance, R. E. Gleason 207,267
Scales, weighing, T. Fairbanks 207,263
Scouring board, G. W. Curry 207,257
Scrubbing device, A. J. Davis 207,108
Scythe snath fastening, G. E. Clow 207,164
Seeder and cultivator, broadcast, G. Esterly (r) 8,385
Sewer trap, W. F. Downey 207,260
Sewing machine, J. Wensley 207,230
Sewing machine, button hole, Furbush & Perley 207,173
Shaft and journal, A. E. Smith 207,313
Ships, elastic armor for, W. M. Stebley 207,218
Shoulder pad, G. J. Schou 207,211
Sign umbrella, W. B. Wortman 207,332
Skirt hook, DeForest & Gilbert (r) 8,378
Snap hook, J. C. Schneider 207,309
Stamp, canceling, W. Krutzsch 207,125
Stove, J. B. Oldershaw 207,296
Stove, cooking, D. E. Paris 207,297
Stove cooking, T. B. Tufts 207,142
Stoves, boiler attachment for, J. M. Killin 207,286
Stump puller, J. A. Jeffers 207,282
Sugar, manufacture of, Frezon & D'Oliveira 207,271
Table, folding, J. Bradfield 207,243
Tacks, cleaning and sifting, H. H. Heald 207,178
Tank, storing, F. K. Plumbley 207,301
Telephone, speaking, E. Gray 207,269
Thill coupling, Gillespie & H. J. & F. J. Springer 207,115
Tobacco cutting machine, Wilson & McCallay 207,146
Tobacco flavoring, M. Chambers 207,106
Tobacco, granulating, Simpson & Howard 207,140
Tobacco machine, plug, Jones, Macomber & McCook 207,121
Torpedo for oil wells, P. E. Wellman 207,325
Toy, automatic swimming, E. Martin 207,188
Truck, car, A. Higley (r) 8,381
Twine holder, S. C. Catlin 207,105
Vapor burner, R. F. Danforth 207,258
Vehicle seat, T. K. Meech 207,193
Velocipede, G. W. Bishop 207,240
Ventilating ships, A. F. Yarrow 207,335
Vessels, unloading grain, etc., from, C. J. Wells 207,229
Wash board, J. F. Jaques 207,184
Wash board, J. T. Sargent 207,134
Wash boiler, E. G. Woodworth 207,147
Washer, hand, H. C. DeWitt 207,109
Washing machine, S. B. Shultz 207,215
Washing machine, T. A. Wilson 207,232
Water closet, C. H. Moore 207,196
Water wheel, endless chain, W. L. Orran 207,202
Welding copper, Williams & Worsham 207,145
Wells, water packer for oil, W. W. Jamieson 207,281
Wheelbarrow, F. Dyer 207,112
Wheelbarrow, G. B. Tennent 207,222
Wheelbarrow, metallic, J. Upstone 207,225
Wind wheel, S. W. Martin 207,189
Window bead fastener, G. M. Evans 207,262
Wire drawing machine, J. S. Winsor 207,330
Wire, forming and tempering, C. H. Morgan 207,201
Wire stretcher, I. G. Ericson 207,167
Wrench, pipe, B. S. Hyers 207,182
Wrench, ratchet, T. C. Hammond 207,117
Wrench, tap, C. H. Fowler 207,172
Wrench with cutter, pipe, J. Brewer 207,102

English Patents Issued to Americans.

From September 6 to September 10, inclusive.

Baskets.—I. L. Cole, Hillsdale, N. J.
Match machinery.—M. Young, Frederick, Md.
Presses.—E. R. Esmond, N. Y. city.
Saw.—G. F. Simonds, Fitchburg, Mass.
Sewing machines.—H. Friedberger, Philadelphia, Pa.
Shingles for roofing.—H. W. Shepard, Brooklyn, N. Y.
Stamp indorser.—E. Gumbs, N. Y. city.
Toys.—W. S. Reed, Leominster, Mass.

Value of Patents and How to Obtain Them.

PRACTICAL HINTS TO INVENTORS.

PATENTS, CAVEATS, ORNAMENTAL DESIGNS,

TRADE MARKS, LABELS, COPYRIGHTS.

PATENTS THE WEALTH OF NATIONS.

Messrs. Munn & Co. For more than thirty years in connection with the publication of the Scientific American, they have conducted the business of procuring Patents in this country and Europe. As in the past, they now have *unequalled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Registrations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

The first inquiry that naturally occurs to every discoverer of a new idea or improvement is, "Can I obtain a Patent, and whom shall I consult?" The quickest and best way to obtain a satisfactory answer without expense, is to write to Munn & Co., describing the invention, with a small sketch, or send a model by express pre-paid. All they need is to get the *idea.* They will immediately answer and inform you whether or not your improvement is probably patentable; and if so, give you the necessary instructions for further procedure. For this advise they make *no charge.*

A patent is granted for 17 years, during which time the patentee enjoys the full and exclusive right to make, use, and sell the invention, and grant rights, licenses, or privileges. There are no taxes to pay on a patent after it is granted in the United States. The owner is not obliged to work the patent within a specified period. The patent remains good and valid, whether it is worked or not.

Preliminary Examination.—Another way to learn more definitely if an invention is patentable, is to have an examination made of the drawings and models in the Patent Office.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive a written report in regard to the patentability of your improvement. This special search is made with care, at Washington.

Caveats.—Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail.

To Make an Application for a Patent.—The applicant for a patent must furnish a model of his invention if susceptible of one, or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail.

Reissues.—A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention. Address MUNN & Co., 37 Park Row, for full particulars.

Design Patents.—Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Trademarks.—Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their trademarks and obtain protection. Security for trade marks can be secured by citizens of the United States in the following countries, at the prices annexed, which includes both the Government and agency fees: Canada, $40; Great Britain, $50; Belgium, $75; France, $75; Germany, $75; Austria, $75. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Foreign Patents and Synopsis of Cost.—The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. Address MUNN & Co., 37 Park Row, New York. Circulars, with full information on foreign patents, furnished free.

Canada.—The expense to apply for a Canadian Patent is fifty dollars ($50), which includes Government tax, agency, and all charges for five years, after which two additional terms of five years each may be obtained on payment of fifty dollars each—in all, fifteen years. The patent covers Nova Scotia, Prince Edward's Island and both the Canadas.

Caveats may be filed in Canada for $25, which includes all expenses.

For further particulars address MUNN & Co., 37 Park Row, New York.

Great Britain.—The British Patent extends over England, Wales, Scotland, Ireland and the Channel Islands, but not the Colonies; the latter make their own patent laws.

The expense to apply for an English patent is seventy-five dollars ($75), which includes Government taxes, agency, and all charges for the provisional patent. No sworn papers are required; no models. The patent issues to the first applicant, whether he be the inventor, or merely the introducer. For additional particulars as to cost for completing the English patent and future taxes, address MUNN & Co., 37 Park Row, New York.

France.—The cost to apply for a French patent is $100, which covers all expenses for agency and Government taxes for the first year. No official examination is made; no model. The longest term of the patent is fifteen years, subject to a small annual tax. Address MUNN & Co., 37 Park Row, New York.

Belgium.—This kingdom, with its population of five millions, is, industrially, one of the most active and progressive nations in Europe.

Belgium is the manufacturing centre for a large portion of the Continent, and Belgian patents rank among the most desirable of those that are taken out by American citizens.

The expense to apply for a Belgian patent is $100. Inventions that have already been patented in the United States may be patented in Belgium. The law and proceedings are substantially the same as in France. For full particulars send for pamphlet. Address MUNN & Co., 37 Park Row, New York.

German Empire.—The new Patent law, covering Prussia and all the German States, was put in operation July 1st, 1877. It was formerly necessary to take some twenty-one separate Patents, costing several hundred dollars, to cover the same territory which is now protected by a single Patent.

The expense for a Patent and first year's tax for a simple invention is $100.

Patents can not be obtained in Germany for inventions that have been previously patented in the United States. Therefore the application for the German patent should be made before the United States patent is actually issued.

Austria.—A Patent is granted for fifteen years, subject to a small annual tax. The expense to apply for a patent in Austria is $100, which includes both agency and government fees. The invention must be worked within one year. Inventions that have already been patented in the United States, if not introduced in Austria, may be patented there. The Austrian patent covers also Hungary, and includes a total population of forty millions.

Russia.—Duration of patent three, five or ten years. The terms can not be extended. The invention must be worked in the empire during the first quarter of the period for which the patent has been granted. No annual taxes. Full particulars may be had by addressing MUNN & Co., 37 Park Row, New York.

Italy.—The expense to apply for an Italian patent is $150, which includes all fees for the first year. The patent is granted for fifteen years, subject to a small annual tax. This country is making rapid progress in industrial enterprise, and has a population of twenty-seven million.

Spain and Cuba.—By the terms of the new Spanish Law, the patentee now covers Spain, Cuba, and all the Spanish Colonies. Duration of the patent, 20 years. The law is substantially similar to the French and Belgian laws. Cost of the patent, including first annuity, $100. This is a new and good field for inventors.

Write for further information to MUNN & Co., 37 Park Row, New York.

Other Foreign Countries.—In the following countries the cost of applying for a patent varies with the period of the grant, which may generally be from five to fifteen years, at the option of the applicant. Norway, Sweden, Denmark, Portugal, British India, Australia, Victoria, Queensland, Tasmania, New South Wales, South Australia, New Zealand, Ceylon, Mauritius, Cape of Good Hope, Jamaica, Guiana.

The expense to apply for patents in the above countries varies, but full information may be had by addressing MUNN & Co., 37 Park Row, New York.

All business, and all consultations, are kept *secret and strictly confidential.*

In all matters pertaining to patents, such as conducting interferences, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice

Address

MUNN & CO.,
PUBLISHERS SCIENTIFIC AMERICAN,
37 Park Row, New York.

OFFICE IN WASHINGTON:—Corner F and 7th streets, opposite Patent Office.